

THE CASE OF BITUMINOUS COAL

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THE INSTITUTE OF ECONOMICS
INVESTIGATIONS IN INDUSTRY AND LABOR

THE CASE OF
BITUMINOUS COAL



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THE CASE OF BITUMINOUS COAL

BY
WALTON H. HAMILTON
AND
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WITH THE AID OF THE COUNCIL AND STAFF
OF THE INSTITUTE OF ECONOMICS

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DIRECTOR'S PREFACE

The Institute of Economics has undertaken a series of studies on coal of which this volume is the second. This inquiry is concerned with the question of how adequately the prevailing form of organization enables the industry to do the things which the community may reasonably expect from it. It is analytical, not constructive. It is limited to an analysis of the current situation and of the prevailing tendencies. It does not include any proposals for the reorganization of the industry. But the constructive study is not to be neglected. Another volume, which will include a discussion of some programs for reconstruction, is already well under way.

The authors express their indebtedness to many men concerned in one way or another with coal, and to the members of the staff of the Institute, for suggestions, for information, and for criticism. They are particularly indebted to Ralph Fuchs for invaluable help in gathering material.

H. G. MOULTON,
Director.

Washington, D. C.,
July, 1925.

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Here's a pretty mess.

—*W. S. Gilbert.*

THE CASE OF BITUMINOUS COAL

CHAPTER I

THE BOTHER ABOUT COAL

Of *that* there is no possible doubt,
No possible, probable shadow of doubt,
No possible doubt whatever.

—*The Gondoliers.*

I. THE QUESTION

A public official of high repute, who does not lack standing as an engineer, has pronounced bituminous coal to be the worst-conducted of all our industries. The burden of his complaint is that coal mines are backward in using machinery, in standardizing practices, and in adopting quantity methods of production. His formula for putting the industry in order is to throw out rule-of-thumb and hand-to-mouth procedure and to borrow from metal-mining and the factory all the paraphernalia of up-to-date efficiency. If such a prescription were enough, we ought soon to be able "to forget all about coal"; for machines, time-clocks, engineers, blueprints, and the other

whatnots of modern technology are at last entering the coal mines. Unfortunately, however, the belated coming of the machine-process and factory management marks the beginning, rather than the end, of a coal crisis. It recreates, rather than solves, the coal question.

Two circumstances make a bituminous coal problem inevitable. The one is the strategic place of coal in the economic system; the other, the unordered character of the industry.

The strategic place of bituminous coal in the industrial order requires no explanation. So obvious is it that Adam Smith's remark, "Coals are a less agreeable form of fuel than wood" seems naïve, and the act of a fourteenth century parliament in outlawing "the burning of coal" as a "public nuisance" almost unthinkable. Very briefly, our whole productive system is built about the machine-process; the machine-process uses mechanical energy; and the great source of mechanical energy is coal.

This strategic position belongs, not to coal, but to bituminous coal. There are many coals, ranging in degree of hardness from anthracite, through bituminous and lignite, to peat. These have oftentimes been subdivided into as many classes as the time and patience of the classifier would allow. But neither a common fossil origin nor the kindred arts of mining used to draw these coals from the ground make their economic problems alike. Anthracite, a rapidly wasting resource, is used largely for domestic fuel;

its problem concerns the coal bin and the coal bill of the ordinary householder. Lignite and peat, low in energy value, are not extensively used. Save where distance makes bituminous expensive, they are a source of future rather than of present power. Between them lies bituminous, a soft coal of great variety, abundant for all current uses, and the great source of industrial energy. If a legal ban were placed against the use of anthracite, the industrial system would be little affected by it. If all our lignite and peat were suddenly removed from out of the ground, our productive processes would hardly be touched. But if the mining of bituminous were arrested, even for a few weeks, our vast and intricate economic system would be thrown into complete disorder.

The industrial primacy of bituminous coal is today unchallenged. As power the labor of human beings is no longer of any current account. The ox as a beast of burden stalks only the dim ways of history and the horse has been dislodged from the treadmill to amble along unfrequented country roads. It is of the irony of time that mules are today employed in the mining of a product which has made their own energy obsolete. The winds, turning more mills than ever before, pump water, grind grain, churn, and do a score of little tasks for a surviving domestic industry; but they list not to blow with enough regularity or violence to keep wheels spinning and mills going. Natural gas seems certain presently to lose its very

frail position in the industrial system. Oil alone, whose sole use was once thought to be a cure for mangy camels, is able to offer limited competition. In its crude state it is used to propel locomotives and steamships; and, in the more refined form of gasoline, it keeps motor vehicles moving. But, even with the Diesel engine and economy in use, oil seems unlikely to make serious inroads upon coal; for oil, like natural gas, is a rapidly wasting asset.

There seems to be no current substitute capable of supplying energy to large enterprises. The hydroelectric industry will probably advance, but its expansion is hedged about with natural barriers. If all the water-power in the country were harnessed, and if it were by some quite wasteless process turned into industrial energy, it would not suffice to keep current industry going.¹ To a limited extent the fall of water can replace coal; but the inaccessibility of water power, the expense in equipment necessary to its utilization, and the waste incident to its conversion and transmission give an immediate chance for a very partial substitution. Even the promise of "super-power," which just now seems to lurk ominously in the offing, is nothing more than to make a ton of bituminous go farther. If, with the lapse of

¹ Steinmetz, Charles P., "America's Energy Supply," in *Proceedings* of the American Institute of Electrical Engineers, Vol. 37, p. 591 ff. For a later estimate see the mimeographed release to the press by the Department of the Interior, under date of April 29, 1924, entitled, "Developed and Potential Water Power of the United States, 1924."

years and the expansion of industry, our demand for power should increase, our current knowledge can point to no other source than coal.

Nor does a developing technology give any future assurance of a rival source of industrial energy. The waves, the tides, the rays of the sun, the atom may well hold stores of energy that dwarf even our reserves in bituminous coal. But the scientific formulas which will unlock these reservoirs and turn them to account have not yet been discovered. Scientists talk glibly about the production in vast quantities of an alcohol from a tropical vegetable and promise a much wider use of the internal combustion engine. But it is far more likely that oil will be replaced by benzol, which is a product of bituminous coal. In fact in Europe benzol is even now extensively used to propel motor vehicles. In the calculable future, therefore, the problem of power is likely to remain the problem of bituminous coal.

But sheer importance cannot make bituminous coal a matter of national concern. Hydrogen is essential to water, without which coal cannot become power; yet for many centuries its existence was not suspected. Government is indispensable to a power-using industry; yet we make matters of state the casual incidents of party politics. It is our constant fear of a crisis, interrupting our supply of coal, and threatening to tie up the productive system of the country, which creates the coal problem.

This bother does not come because our total re-

sources are inadequate. The coal-bearing seams of the country contain nearly one and one-half millions of millions of tons of bituminous, taking no account of sub-bituminous and lignite. At the current rate of use, which is between five and six hundred millions of tons a year, this should last for more than two thousand years. But since our anxiety is about the stuff of which power is made at the places of conversion rather than about physical tons in the ground, this rhetorical calculation overshoots the mark. With the wastes which attend even the best methods of mining, the inferior quality of many coals, and the coal-consumption needed to get fuels to the places of use, these resources may fall well within this outward limit. If, in spite of better methods of consumption, more and more coal should be demanded, this span of the life of deposits may be materially shortened. More important is it that sooner than we realize we may be confronted with a real scarcity of high-grade steam coals, of coking coals, of coals adapted to fine metallurgical purposes. Such supplies must be diligently guarded. But, apart from special cases, a nation prone to expect the most of discovery and thinking little of a morrow which is centuries off, is not worried primarily over limited coal resources.

Our concern is due rather to a lack of faith in the organization of the industry. Although national well-being depends upon goods produced by mechanical power, we have consciously formulated

no scheme to insure its continuous flow. Although industries demand an uninterrupted stream of coal, the business men who control them have taken no concerted action to avoid a coal famine. Strangely enough, and naturally, they have depended upon profit-making to induce those who own the resources to mine enough coal and to get it to market; upon the need for wages to keep miners regularly at work; and upon competition to beat the price down to what consumers should pay. The results have been an irregular production of coal, a vacillation in price, a failure in supply three times within a period of ten years, and enough disorder among the establishments which make up the industry to make business judgments a gamble. The clash between what the community expects from an orderly industry and the actual performance of the world of bituminous is the source of the modern mystery of much ado about coal.

Out of the strategic position of bituminous coal and the prevailing disorder in the industry, the coal question emerges. That question, like others old and new, falls apart into two closely related inquiries. The one is an analysis of the present position and future prospects of the industry. This comprehends a statement of the demands which may reasonably be made of it, the ways in which it meets and fails to meet these obligations, and the incidental and persistent sources of these performances and shortcomings. The other is a constructive attack upon

BITUMINOUS AND LIGNITE RESOURCES IN TERMS OF POWER UNITS.
(Based on figures of the U. S. Geological Survey.)



One dot (.) the equivalent of 1 billion tons medium rank bituminous (heat value 12,500 B.t.u.s)

the problem of organization. It involves a consideration of "proposed roads towards order," and the formulation of a program for putting the industry in the way towards becoming a well-conducted one. The task of analysis falls to this inquiry; that of prescription must await a future study.

II. THE INDUSTRY

The coal industry is the instrument through which the productive system of the country taps our natural reservoirs of power. The map on page eight shows that there rest in the ground generous deposits of bituminous coal, distributed over different sections of the country. The great reserves of high grade coal are in the Appalachian fields, extending from northern Pennsylvania, across Ohio, West Virginia, Kentucky, and Tennessee into Alabama. The coal in the interior provinces is of somewhat poorer quality, and that in the West is still poorer. Much of that in the great fields of the Rocky Mountains is of very low grade or lies in such a way that it is difficult to win. But in terms of reserves of power units, these western fields are the most important in the country. If the reign of bituminous endures, the future, that is the far distant future, lies with the West.

At present, however, the center of the mining industry is in the East. The tonnage from Pennsylvania, West Virginia, Illinois, Kentucky, and Ohio constituted about four-fifths of the total output in

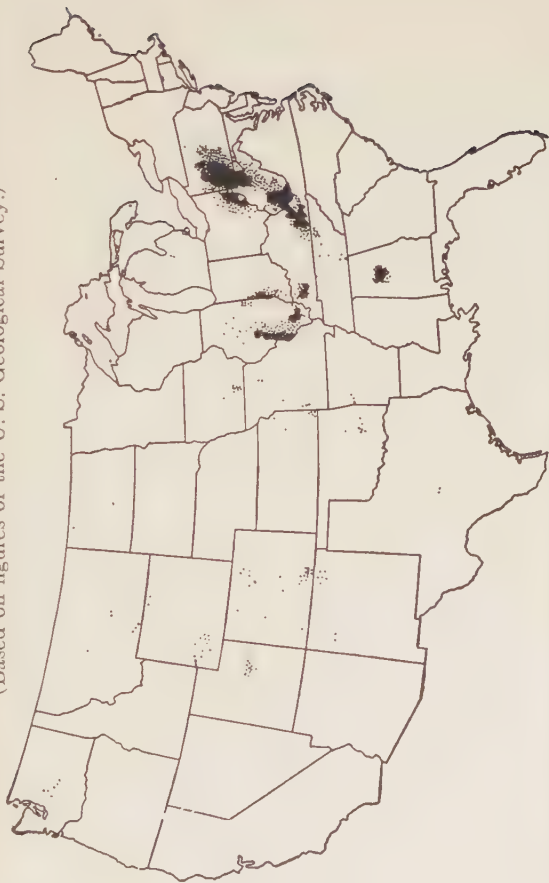
1923, and that of the two states of Pennsylvania and West Virginia almost a half.

Nor are these fields in any immediate danger of losing their dominant position. Their reserves, although small in comparison with those in the West, are not only of high grade but are sufficient to maintain the present rate of production for a century or more. Likewise the advantage of location lies with them. At the present time, the demand for coal is greatest in lower New England, in New York and the tributary states of New Jersey and Pennsylvania, and in the metropolitan area of Chicago and other large cities. While it comes in increasing volume from all sections of the country, its center still lies well to the east of the Mississippi River. Thus the primacy of the eastern fields is in no immediate danger.

The demand for bituminous coal is largely a demand for power, rather than for fuel. The consumers accordingly are great industries. The railroads use about a fourth of the year's output, the manufacturing industries almost a half, the iron and steel and other metallurgical industries about a fifth,² domestic consumers less than one-tenth. The demand, determined very largely by the pattern of the industrial system, varies with the volume of production. The mining industry accordingly is affected by the ups and downs of business activity, and must

² U. S. Geological Survey, *Weekly Report on the Production of Bituminous Coal*, No. 210.

PRODUCTION OF BITUMINOUS AND LIGNITE IN 1922, IN TERMS OF POWER UNITS.
(Based on figures of the U. S. Geological Survey.)



One dot (.), the equivalent of 400,000 tons medium rank bituminous (heat value 12,500 B.t.u.'s)

make such adjustment as it can to the resulting uncertainty and irregularities. But coal is sold indiscriminately to all industries. Mining, therefore, has the advantage of a wide distribution of risks, and is not subject to the violent fluctuations in demand characteristic of some more highly specialized products. The market, at least, offers no insuperable difficulties to planning production to meet requirements.

Curiously enough figures on the value of coal give little clue to its strategic place in the industrial system. The total value of coal as it leaves the tipple runs well over a billion dollars a year; in 1921 it amounted to a billion and a quarter. But this was noticeably less than the value of meat products, or petroleum, or motor vehicles, and slightly less than that of cotton goods.³ Nor is the importance of coal shown more clearly by the place of fuel costs in the expense budgets of individual industries. Even in central light and power stations the cost of coal is only about one-fifth of the total expenses;⁴ on the railroads it is not much over one-tenth.⁵ At the other end of the scale are large numbers of industries whose production would stop if their power was cut off, but whose fuel costs run around one and two per cent of their operating expenses. They include in-

³ Coal values from Tryon, F. G., and Hale, Sydney A., *Coal in 1919, 1920, 1921*. Other values from U. S. Census of Manufactures, 1921, p. 19.

⁴ U. S. Census Bureau, *Electric Railways*, 1917, p. 34.

⁵ *Statistics of Railways in the U. S.*, 1921, p. cvi.

dustries of such importance to the community as the manufacture of boots and shoes, the men's clothing trade, and the automobile industry.⁶

The coal industry is more than an instrument for tapping our power resources. It is the means by which part of the population is provided with a living. For the task of taking coal from the ground and starting it on its way toward becoming power requires the labor of thousands of individuals who look to the mining industry for support. Viewed from this angle the importance of coal in the national economy is easily seen. No manufacturing industry has undertaken to provide for so many persons. Even the cotton goods industry which employs more wage earners than any other had only 421,000 in 1921, compared with over 660,000 reported for bituminous coal.⁷ Only agriculture and transportation are more important as a source of livelihood.

These 660,000 workmen and their families make up a group of over three million persons who look to the coal industry for their daily bread. Gathered together they would make up a city with a population as large and almost as heterogeneous as that of Chicago. For the isolation of the mining districts has not acted to keep out the tides of on-coming immigrants. On the contrary, the composition of the

⁶ Abstract of the Census of Manufactures, 1919, p. 484, ff.

⁷ U. S. Census of Manufactures, 1921, and Tryon, F. G., and Hale, Sydney A., *Coal in 1919, 1920 and 1921*.

mining force has reflected fairly accurately the different waves of immigration. Today about 60 per cent are native born white, 8 per cent are negro; 5 per cent are of the races of the old immigration, and the rest come from the countries of eastern and southern Europe, Italy, Austria-Hungary, Poland, Czecho-Slovakia and Russia, in the order given.⁸

They are truly a varied group, with different traditions behind them, different aims and ideas. The one thing that they have in common to set them apart from other workers is their connection with the mining industry. To some of them this common interest is a lively reality. For the miners in the great central coal fields have banded together to form the United Mine Workers of America. To the miners in the outer crescent of the coal fields, however, West Virginia, Kentucky, Alabama, on the east, Utah and Colorado on the west, connection with a single industry has brought less consciousness of group interests. For they have been effectually protected from contact with the union and their isolation has made it difficult to develop organization locally.

The division of the working force into union and non-union groups, important as it is to the mine-workers, is reflected in the structure of the industry

⁸ U. S. Coal Commission, *Bituminous Mine Workers and Their Homes*. Page references to the reports of the Coal Commission cannot be given at this time, as they are still in press. The mimeographed form in which they were originally issued and used in the preparation of the volume are not easily available to the general reader.

itself. A great deal of the chaos that is coal can be attributed to the existence of this industrial fault line. To it must be attributed most of the bloodshed which has brought the industry into disrepute.⁹

Other groups to whom the coal industry represents a source of income are less numerous. But they occupy a position of greater strategic importance, and they demand better livings. Four thousand proprietors and firm members, nearly 6,000 salaried officers, 10,000 superintendents and mine managers, and 2,500 technicians and near technicians, make a total managerial group of 22,000 persons to be supported by coal mining.¹⁰

Investors likewise expect income from the mines although possibly few absentee owners have staked their all in an industry in which the reputed risks are so great. Who they are and how many, what part their prospective returns from coal forms of their total income, is not reported. But there is no evidence that widows and orphans have looked to coal mining for a safe investment.

This, very briefly, is the industry which is the subject of the present inquiry. These are the demands made upon it. These are the natural and human resources with which it undertakes to perform its appointed task.

⁹ See Chapter X, "The Crisis for Labor," for the meaning of the non-union fields in the current disorganization.

¹⁰ U. S. Census of Mines and Quarries, 1920, p. 44.

III. THE LIMITS OF INQUIRY

A word about the frontiers of this study. Its concern is the economics, not the technology, of coal; its objective to lay bare the current position and the future prospects of a great public service. But it is the winning of coal around which the industry is built; it is this which makes it different from the production of steel, the making of motion pictures, the preaching of the gospel. For that reason the art of mining cannot be left out of account. If the argument strays off after "pillar and room," the "panel system" and "retreating long wall"; if it addresses itself to conveyors, hoists, haulage, and other mechanical devices; if it seems over-concerned with blueprints, mine capacity, and "snow-birds," it is not to discuss these things as an engineer would discuss them. It is, rather, to relate these elements of the technician's craft to the cost of coal, to the price curve, to the wages of labor, to the index of employment, to the number of bankruptcies, to the larger problem of holding efficient establishments within a neat and orderly industry.

And, if it seems that the discussion wanders beyond the world of bituminous, it is not really so. That domain is a small one, impinged upon all sides by other industries, alien authorities, strange habits and ideas. From beneath the tipple flows a stream of coal, now steady, now interrupted, that keeps a great industrial system going and permits

the population of a nation to wring from it livings fat and lean. From the great world beyond the tipple into the smaller one of coal come the tools and machines which make mining possible, the demand which tells whether the mine shall run or not, the goods and services which give abundance or scarcity to the miner's real wages; the new ideas and practices which may play hob with an ancient craft; and the old customs and values which enable mine-workers to make what they can of life in the coal community. From without, too, comes the control of absentee owners, the supervision of the state, the competition of other industries for workers.

Such matters are not apart from this inquiry. To discuss them does not involve excursions from the blacklands into foreign parts. For, as such instruments and ideas, such products and customs pour out and come in, their influences upon the human microcosm of coal must be taken into account. Such influences from far and near are as much a part of the reality we seek as are pick-miners, face-conveyors, and mining layouts.

Finally, this study does not consider all the industries built about coal. Man's concern with coal, including as it does its mining, its transport, its delivery, its conversion into power, may be pictured as a single industrial process, stretching away from the "face" to the boiler. These various activities, each of which has an industry built about it, should be so co-ordinated that coal moves without interruption

from the seam underground into use. But this book cannot address itself to the problems peculiar to these other industries. Since the focus of this discussion is the mining of coal, irregular transport, wasteful distribution, and inefficient use receive attention only when they threaten to impede the free flow of coal from out the mine. Accordingly, the prosaic recitals of the carriage of coal and the acquisitive annals of its salesmanship are not for this volume. This inquiry ventures only where the self-respecting miner goes; its limits are the face and the tipple.

CHAPTER II

THE COMPETITIVE IDEAL.

And noble statesmen do not itch
To interfere with matters which
They do not understand.

—*Iolanthe.*

I. THE PREVAILING ARRANGEMENTS

A study of the coal question should begin at the beginning. The proper beginning lies, not in the technical mysteries of the art of mining, but in the system of free enterprise under which the industry has been encouraged to develop. Two circumstances unite to make "the rules of the game" as it is played in the coal fields, the focus of this inquiry. The one is that the prevailing organization of the industry is the most stubborn fact in all the coal problem; that the smoothness or the friction with which it works determines whether seams shall give niggardly or with abundance. It is the "competitive system," as it is popularly called, not operators, or processes, or mine-workers, which is on trial. The other is that, however meager and vague they may be, the expectations which underlie free enterprise are the only standards at hand by which performance may be judged.

While it has not always been so, in the fragment of the past which concerns the problem, bituminous coal has been organized under free enterprise. As with many another industry, the community has never called upon the operators to formulate a scheme for keeping the industry in order, employed a staff of competent engineers to push forward a national program of production, or taken any steps deliberately to secure the regular flow of a strategic commodity. Instead, it has retained an organization which permits anyone to mine coal who has the necessary assets, pits corporation against corporation at money-making, and sets worker to vie with worker in search of employment and wages. The idea has been that the competitive system means fairness to all concerned, and coal.

It would require more pages than there are in this book to list and to describe all the changing arrangements which make up this "obvious and mysterious" system. It is enough to mention, briefly, two pairs of institutions, which are at the heart of the scheme, and each of which in its way epitomizes it. They are "private property" and "contract"; "profit-making" and "competition."

The first two institutions, private property and contract, supply the mechanics of free enterprise. Private property is a system which determines who shall hold and control the resources of society; contract, a scheme which provides for bringing different instruments together in the productive process.

Under free enterprise the owner of a farm, of coal deposits, or of a manufacturing plant can exploit his resources himself, hire others to work them for him, lease the properties to someone else, or withhold them from use. Subject only to the police power of the state, he may "do what he will with his own." If he hires others to exploit his resources, or leases his properties, he makes a contract. This is an agreement, freely entered into by the two parties, and containing obligations and conditions which are mutually satisfactory. It is by contract that productive resources and those who undertake to exploit them are brought together; that investment funds are secured for conversion into machinery and equipment; that laborers of various trades are found to do all sorts of work; and that the finished goods are disposed of to their users.

The other two institutions, profit-making and competition, are depended upon to direct the industry to its proper ends. Profit-making is the bait that lures individuals and corporations into industry, impels them to produce goods, and thus forces them to serve the community. Competition is "the invisible hand," of the older economists and of more modern judges, which holds profit-making within appointed limits and directs it into the service of the community. Under its regime the consumer is supplied with "good cheap products," for the seller must vie with other sellers in disposing of his wares. In addition the laborer enjoys good working conditions

and is supplied with the requisites of a proper life; for employer must vie with employer in securing and holding workers. In like manner the industry in its growth is adjusted to the changing needs of a developing industrial order. Or, to mix metaphors, the lure of profits causes the industry to go while competition directs it and, when necessary, applies the brakes.

Yet, neither in bituminous coal nor in other industries, is the scheme of order as simple as all this. Each of these four institutions, property and contract, profit-making and competition, is itself a bundle of many usages; each has a history reaching into the distant past, each has a content obedient to passing circumstance. Moreover, as time has passed, the scheme of order has been disturbed, and for many industries seriously confused, by regulation from without and by new controls from within. In bituminous coal, as elsewhere, as the argument shows,¹ tendencies at variance with free enterprise have appeared. But here, as in few other industries, their headway has been arrested, and the primitive order stands out clearly behind the patch-work of compromises.

It chances, therefore, that the problem of order or chaos in the industry is the problem of how well the system of free enterprise works; that the prevailing rules of the game are the beginning of the coal question.

¹ See Chapter III, "The Compromised Control."

II. THE TEST OF AN INDUSTRY

If one is to determine whether or not the competitive system "works," the performance of the industry must be tested. The management does not exploit resources for the joy of the venture; the miner does not work that labor may be its own reward; and no cult proposes the creed of coal for coal's sake. Instead the meaning and value of the whole round of processes and activities which make up the industry flow from the services which it performs. The industry is an instrument, a useful agency of the community. Those who are concerned with it,—operators, investors, miners,—are there because the public expects from them a necessary service at a reasonable return. The goodness of its organization, or its badness, depends upon how well or how poorly it meets this simple test.

But if performance is to be tested, there must be standards of appraisal. And where are devices for measuring the work of the bituminous coal industry to be found? No authoritative body has issued a formal statement of what may reasonably be expected of an industry. No text in general repute, in words which invite no misunderstanding, contains a statement of "the ends of an industry." No investigating committee, clothed with the powers of state, has reduced to definite terms the tests it must employ to determine whether it should approve or

condemn the practices which make up the organization of an industry.

The quest for standards, however, is by no means hopeless, even if it leads to no canonical utterance and lies along a way far removed from eternal verity. The values, the usages, the conventions of the system of free enterprise, the thoughts men have about it, the arguments which are used to defend it, are literally saturated with notions of what the system is supposed to do. These promises of competition, or these expectations which men hold of it, are not to be found in popular speech and writing as a clear-cut, coherent, definite scheme of thought. Instead they constitute, if the word is not too strong for a thing so diffused, a sprawling mass of vague and half-articulated ideas, which appear in fragments as the scattered defenses of an established order. Yet, for all that, these inchoate ideas fit together with remarkable harmony into what may be called, without inexactness in the use of words, "the promises of the competitive system."

The materials which may be drawn into a formal statement of what is reasonably expected of the industry exist everywhere in abundance. If one suggests a regulation of the price of coal in the interests of the consumer, the answer is that competition prevents an overcharge. If one recommends the organization of miners in the non-union fields as a means to better livings, he is told that the bidding of coal-field against coal-field for workers is the best protec-

tion of a high-wage scale. If one proposes that something be done about wasteful concerns which inflict the industry with their presence, he is reminded that they cannot survive in a struggle against their efficient rivals. In short the use of an agency outside the scheme of free enterprise is invariably opposed with the dicta, "Let the industry alone," "Turn coal loose," and "Leave it to competition." Occasions may vary, the points at issue may shift, the defenders of the existing order may be a motley throng each of whom holds the line at only one point and makes common cause with no others. But, strike where one may, there is at every point an argument for competition which turns upon its promise of performance.

This general evidence of expectation does not mean that free enterprise was fastened upon the bituminous coal industry in order that it might do the things it ought to do. The system was not set up in order that an industry might be orderly, that it might generations later lead to a popular bother over an unruly instrument of production, or that students who wished to write of the coal question in words of one syllable might be confused. Nature produced no such peculiar sport as the competitive order; no great convention, called to consider the muddled affairs of industries, contrived such a constitution for the economic order; no great enactment of a parliament of trades put such a scheme in practice. Such purposiveness does not belong to the realm of human

affairs. Instead, while its history is replete with little decisions, and some big ones are chronicled, the general scheme of free enterprise was in existence long before its elements were clearly remarked.

It, therefore, is half true, half untrue to attribute its general prevalence, or its dominance over coal-mining, to intent. There was choice in that an older system of regulation was rejected because of the mischief it had done; and one of monopoly, because of the greed it had shown. There was accident in that there was no conscious attempt, by invention and adjustment, to contrive a general organization for an industry, no weighing of alternative schemes, no choice of this procedure and no rejection of that device. So, too, it has been with its retention. Intent seems to be dominant in the embodiment of this scheme of arrangements in business practice and in legal arrangement, and in the conscious resistance which is opposed to every proposed departure. But accident, too, is apparent among these defenses. For the usual reasoning says little about the relative advantages of the competitive system over alternative forms of organization. Instead its arguments are the conventional arguments for the order which is established, whatever be the acceptable ways which make it up.

In all likelihood a growing belief in the efficacy of free enterprise lagged behind the fact. But it was inevitable that about the scheme, once established, a dialectical defense should grow up. This appears, in

most articulate and refined terms, in abstract systems set forth by many writers on economics in the nineteenth century. In less rigid principles it lies at the basis of the attempt through anti-trust laws to preserve competition, and accounts for the impatience of many courts with the use of regulation to accomplish what had best be left to the automatic workings of natural law. In a still more popular form it appears as a loose bundle of popular presumptions about what the system is supposed to do. But, whether it be met as pure theory, as legal dictum, or as plain common-sense, the system is father to the argument; the institution, the creator of the promise.

Strangely enough, although the items which make up this general promise are matters of course to interested parties, the competitive ideal as a whole is less apparent to the public than it was two generations ago. This is because the system has of late been qualified at so many points. The rise of trade unions, the formation of coal associations, the prescription by the states of safety codes, the intervention of government to settle labor disputes have grafted upon a competitively organized industry new agencies of control which have blurred the popular picture and confused its promises. A waning faith in non-interference, an unwillingness to think of competition as going all the way, and a knowledge of departures have tended alike to conceal its continuing dominance and to hide its professed goal of

public service. But despite current confusion in thought, the things which public policy would have the industry do are not hard to disentangle from conventional statements of the case for competition.

In this country the system is rarely, if ever, defended on the grounds that profits are the end of competitive activity, that perquisites are to be given to the privileged, or that enterprises are endowed with a benefit of business. On the contrary the scheme of property and of contract, of profit-making and of competition is defended as an instrument of order, of cheaper coal and better, of the wherewithal of life to the dependents of the industry. If any criteria are to be set up for testing performance in the industry, surely none are more fitting than the common-sense expectations which saturate the reputable belief in free enterprise.

III. THE RULE OF REASONABLE PERFORMANCE

If, then, standards of reasonable performance are to be used to appraise the industry, the argument calls for a statement, in some detail and with some precision of what may be called "the promise of competition." It will promote clarity in the paragraphs which follow to set this down under the general heads of economy and order, the protection of the consumers, and the concern for those who get their livings from the industry.

The competitive system promises an economical organization and development of an industry. Under

its regime each of the units which make up the industry must tend to be an orderly establishment run with little waste. It could not well be otherwise; for disorder, or lack of economy, means higher costs, higher prices, and an inability to compete against coal producers who have banished chaos from their properties. Again, the separate undertakings must be articulated into a unified industry. Competition, far juster than the rain, will grant survival only to the efficient; and, merciful as it may be for a while, it will in the end deny economic life to enterprises which are wastefully run.

Likewise the industry must be properly correlated to other industries; for, in the endless struggle which is promoted, just enough efficient concerns will survive and they will tend to absorb about enough of the productive resources of the nation to supply it with the coal which it requires. The presence, occasionally, of more or less than the requisite number of mines, of an over- or an under-supply of equipment, or of a surplus or a dearth of workers, is only the friction incident to the adjustment of the industry to the changing demands upon it.

It is eloquent of this automatic process that the loss through over- or under-production tends to a minimum; that the capacity of the industry tends to be adjusted, constantly and wastelessly, to the changing demands upon it; that the trend of the cost of production is towards the minimum.

Under the competitive system the rights of the

consumer are adequately safeguarded. Coals must be of high quality and their prices cheap. This guarantee has its source in economic law and is far more valuable than the mere written word of the seller. No company can palm off low quality fuel or give stones to those who pay for coal, for those who receive without giving are eventually detected and are forced to change their practices or to lose their customers. Nor can the producer for long charge more than the traffic will mercifully bear. If he attempts to do so, he will be circumvented; for there will always be concerns able to increase their production, and our abundant resources at all times make it possible for others to go into mining. A price which is unreasonably high, by its very promise of profits, encourages increased output, and in an open industry in time automatically corrects itself.

Such protection to the consumer is effective against wasteful competition. The consumer has his coal at a price which in the end represents only the necessary costs of production. Since each producer seeks profits, which are a surplus of receipts over expenses, he is assiduously engaged in reducing his costs. If he fails, there is the constant threat of the outsider, for the extent of our coal resources opens the industry to anyone who by skill or cunning can reduce mining costs. Accordingly the industry cannot for any great time absorb more laborers, use more materials, or pay more for investment funds than are necessary. Nor can workers, who also must

compete with each other for jobs, continue to spend their time in ineffective ways of work or dissipate it in idleness. In all matters of economy and waste, the double competition of workmen for jobs and of companies for custom leaves only the efficient in the industry, reduces costs towards a minimum, and imposes upon the consumer the lowest price.

Its protections are effective particularly against would-be profiteers who would squeeze out extravagant returns between expenses and receipts. In an open industry those who organize new ventures and those who keep old ones going can on the whole get only reasonable returns for their services. The enterprising company may still make differential profits by keeping its costs below those of its competitors. But competition quickly drives rival concerns to copy any economy, and if the progressive concern would keep on making large profits, it must forever be alert in developing and applying new methods.

In fact such differential profits are a spur to progress within the industry. One concern, by expensive experimentation, invents a process of mining coal with less human labor. Another learns enough about ventilation to make a profit in working seams that have been left unexploited. A third varies the pattern of laying out a mine to the end of getting more tons of coal for a given outlay. A fourth reduces the cost of coal at the tipple by putting its haulage system to rights. In fact, every progressive concern,

lured by profits which competition is constantly whittling away, bends every effort to advance as rapidly as possible each of the many technical processes which make up the art of mining. Thus, inconspicuously, and with no conscious pother over it, technology is rapidly advanced.

For a time, at least, the concern responsible for the improvement reaps in profits its reduction in costs. It may even, by securing a patent for the new invention or the new process, reap where it has sown for a period of years, though few who know practical coal mining will regard this as much more than a possibility. Shortly those who employ the new methods will expand their output. This, by increasing the part of the supply produced at a cost lower than current price, will reduce price. Eventually the improvement will go into general use, lowering costs uniformly, and price automatically. Such differential profits are a sound investment for the community. They make for improvements which, unless wasting assets forbid, tend in the long run to make the curve of the price of coal run ever downward. Thus, in the competitive picture those who control coal companies are lured by temporary profits to make lasting improvements in technique and organization; while those who consume coal, the beneficiaries of economy, idly gather the unearned increment.

At only one point does the argument that competition blesses the consumer stumble. It seems to

insure cheap fuel for the present generation at the expense of using up "the cream of the coal." For competition seems to lead to a concerted attempt to keep costs low by taking coal from the richest seams. The opposing argument that the very threat of scarcity in the future gives to coal supplies an enhanced value which tends toward their conservation is irrelevantly true. The insistence that even if we have a little the better of the coal, the folk of the future will likely have the better of the technology and that they owe us something for the highly developed industrial arts we shall bequeath to them is too clever to have much to do with the case. But what is one black mark against so generous a promise?

Under the competitive system, likewise, those who draw their livings from the industry must have whatever chances there are at the fulness of life. To the ordinary miner the possibilities of existence appear most vividly in his wages, which are protected by a double competitive line. There is first the competition of the concerns within the industry for labor. This drives wages up and compels the employer to pay to every laborer the full value of his service. There is, second, as a guarantee and reinforcement, the competition with other industries; for bituminous coal must take its workers from the general labor market. If earnings tend to be low, it is because of no actions of employers, but because of the competition of laborer and laborer for employment. The market records with reasonable accuracy

the wage-rates which are implicit in the forces of demand and supply; in general the laborer escapes exploitation and receives in wages as much as the situation can be made to yield.

In the same manner each of the conditions of work is constantly being redefined in approved practices. The arrangements which affect hours, discipline, safety, health, and the like are all voluntarily entered into by miners who are free, not only to accept or to refuse work at a given mine, but also to enter the industry or to work elsewhere. Every advantage which they want, and which the economic system can allow, is hedged about by this double competitive barrier which the most ignorant and vicious employers cannot break down. And, again, if in any of these matters practice falls below what is easily attainable, the fault probably lies in an overplus of numbers or in a willingness of mine-workers to take less than they may have.

As it is in general, so with each of these items. If, in a particular mine, or in the bituminous coal industry, hours are long, the offenders lose by so much their ability to attract workers. They cannot compete in the labor market unless compensation is made in increased pay or in some other material way. The miner cannot be subjected to severer discipline than is the farm laborer or the factory hand. If work underground is more disagreeable than work upon the surface higher wages or some other extra inducement is necessary to persuade a worker to en-

ture it. If his work makes the miner unduly subject to disease, a little fatter pay envelope, or its equivalent, tends to eliminate the difference. Even the extra risks of accident are smoothed out by the even handed calculus of the market. Either the mining companies will be forced to adopt safety codes which will eliminate all chance peculiar to the industry, or they will be compelled to add to the wages paid in other occupations enough more to persuade the miner to accept the hazards of his craft. Under perfect competition the miner finds this extra bit just enough to enable him to protect himself by purchasing insurance. Nor in the long run can there remain in this intermittent industry an unemployment problem. The competition of other industries for men will force those who control coal mining either to eliminate unsteady jobs or to compensate for idleness by higher wages or its equivalent.

Thus the lot of the miner, all things considered, is in one mine about what it is in another, and in mining about what it is in other industries. Even more, since miners are much alike, since they attach importance to much the same things, and since they are prone to compare wages with wages, and hours with hours, rather than to resort to the more complex calculation of substantial equality when all things are taken into account, there will be a reasonable uniformity in work, condition by condition, between mine and mine, and between bituminous coal

and other industries competing for its labor. The standards established may not be ideal, but they will tend always to be as humane as the larger situation will allow.

Even the questions of civil rights and of the quality of life in the mining village are not wholly beyond the influence of free enterprise. The men who mine our coal either prize legal freedom and political rights or they do not. If they do not, it is of no avail to force these blessings upon them. If they do, they will have them; for those who own and lord it over coal operations cannot deny miners what they may freely have by going to other places or into other industries. Nor can mining villages be generally and permanently inferior in housing, in sanitary arrangements, in educational advantages, in recreational facilities, to industrial villages generally. In all such matters the mine-worker is protected by a beneficent scheme which, to his advantage, pits not only mine against mine, but the bituminous coal against other industries, in a demand for his services.

As with labor, so it is with each of the other groups who are dependent upon the bituminous coal industry. So long as free enterprise prevails the usual interest payments will be only enough to insure a continuous flow of the investments which the industry requires. This payment, however, will be a reasonable return upon the investment as measured by the market value of funds. So long as competition is maintained operators will receive in profits enough

to recompense them for their risks and to persuade them to take them. There will, it is true, be business failures. But, even in periods of change, the adjustment of business enterprise to public demand will be effected as nicely and with as much economy as may be. Protracted periods of disorder will be rare; the threat of bankruptcy will not for long hang like a cloud over the whole industry.

Likewise managers, engineers, foremen, and functionaries of every kind and degree will be found when they are needed, and then at reasonable prices. There will, again, always be cases of over-payment and under-payment, when the friction incident to the progress of the system is more apparent than the order which it conceals. But, by and large, a double competitive process will insure to all who furnish funds, materials, and services an adequate return with a usual imposition of only necessary costs upon the industry.

In all of this, quite properly, competition promises, not absolute, but relative answers to the questions which it faces. The argument is not that the mine and the industry will attain a given standard of order; that all wastes, or certain specified ones, will be eliminated; that the consumer will get coal of a predetermined chemical composition and will pay for it a fixed price; that wages will be high enough to allow to the laborer a specified budget of goods and services; or that the life of the mining community will accord with a prescribed pattern.

On the contrary, those who cherish the competitive ideal realize that final answers cannot be given to such human questions. They are aware that this is a world of scarcity; that wealth is not equal to all the demands made upon it; and that at best our ideals of prices, wages, working conditions, and the like, can never be perfectly realized. They know that such things as the wealth of the country, its industrial equipment, and our knowledge of the processes of production fix the changing limits within which such mooted questions must be constantly reanswered; that a comfort today may be a necessity tomorrow. They argue only that competition orders the affairs under its control in about the best way which the conditions permit; that the answers which it gives are as rich in human values as the circumstances to be met allow them to be.

One characteristic of this dialectic of free enterprise requires a word more; for if it is to be accepted, this study is unnecessary. It is that "the great promise" of competition requires no verification in fact. The test of the price of coal, of the wages of labor, of the profits of enterprise involves no recourse to an objective standard. Likewise working conditions, protection against the hazards of the trade, safety for investors, progress in technical matters, the accommodation of mines to new methods, and economy in organization are to be judged by no definite and tangible criteria. Instead, the rightness of these things is referred to the market. Since establishment must vie with establishment, and in-

dustry with industry, all such matters must be in the coal fields as they are elsewhere. If, however, the inquiry be pressed, and questions be asked concerning profits in general, wages in general, order in general, economy in general, the reasoning runs back to the logic of free enterprise. In short, the guarantee of adequate performance, point by point, is found to lie in the presumptions of the system under which the whole economic order is arranged.

At this point the inquiry must break with the dialectic of the competitive ideal. It has no concern with the goodness or badness of free enterprise as a whole; its pages do not run forward to a judgment about whether competition is best for industries in general or for any other single industry. Industries may very well be quite unlike or some one industry may be unique; a form of organization which is ideal for the great run of industries may be ill-adapted to a particular case. Furthermore, bituminous coal is enough, perhaps more than enough, for one book. The concern of this section has been to discover standards for testing specific performance in a single industry. It is enough that the competitive ideal has revealed these.

A test of results by standards which represent what is generally expected of the industry should be welcome. If the facts fit the ideal, the competitive organization of the industry is vindicated. If they do not, a knowledge of likeness and unlikeness between promise and performance is essential to a program for getting the industry in order.

CHAPTER III

THE COMPROMISED CONTROL

Things are seldom what they seem,
Skim milk masquerades as cream,
High-lows pass as patent leathers,
Jack-daws strut in peacocks' feathers.
Very true, so they do.

—*H. M. S. Pinafore.*

The ideal of an industry controlled solely by free competition has been only partially realized in coal mining. For one reason or another, restrictions have been imposed upon the freedom of those who direct the business enterprises. The organization of the business units has not left control solely in the hands of owner-managers. Ignorance and the dominance of custom have interfered with the enlightened pursuit of self-interest. The relation of one concern to another has not been merely one of competition, but elements of monopoly have entered to disturb the picture presented by the ideal. These compromises with free enterprise are spots upon the pure white of the competitive ideal.

At first glance, however, the resemblance of the industry of today to the ideal is more apparent than its divergence. It is and has been true that any one

is free to enter the coal industry. It takes some capital to acquire coal land, and to equip a mine, but the amount has not been excessive. Any one able to meet this relatively easy requirement has found no difficulty, either legal or economic, in entering the mining business. It has been equally easy for the laborer to enter the mines. The United Mine Workers has not, after the manner of some unions, sought to keep down numbers by high initiation fees, rigid qualifications, or a long period of apprenticeship. Instead it has welcomed into its ranks as many as could find anything that might pass for a job in the mines. The only artificial restriction has been the requirement in some states of a certificate of competency from those who would work at the face. In short, for both workers and operators coal mining has long been an open industry.

The ease with which business enterprises have been able to enter the coal industry has insured the diffusion of control which the working of competition assumes. Possibly the coal industry out-Herods Herod in this respect. At the time of the last census, over seven thousand business enterprises were engaged in mining coal, without counting the innumerable "wagon mines," "snow-birds," and "fly-by-nights" whose output is insignificant and whose sojourn in the industry is fleeting. To be sure, the large corporation, whose employees are numbered by thousands and whose output runs into millions of

tons is not unknown in the mining field. On the contrary, about half of the tonnage comes from companies with an annual output of 500,000 tons or more each.¹ But no one company or no small group is in a position to dominate the industry. The largest of the coal corporations controls no more than 3 per cent of the total production,² and it takes nearly 200 companies to control over 50 per cent of the tonnage.

Moreover, the most diligent monopoly seekers have unearthed no evidence of "combinations in restraint of trade." One eminent student of coal has said that "nature enforces the anti-trust statutes in the bituminous industry."³ However mistaken he may be about the cause, not even "gentlemen's agreements" or "Gary dinners" have been discovered. To be sure, the trade association, even a national organization, is found as in other industries. But the control it exercises is less here than in some others: and on the whole the spokesmen of the mining corporations speak with reasonable accuracy when they talk of the "highly competitive" nature of the industry. At this point, however, the resemblance between the ideal and the actual comes to an end. Careful scrutiny of the coal industry as it is reveals

¹ Tryon, F. G., and Hale, S. A., *Coal in 1922*, pp. 538-40.

² Bituminous Operators' Special Committee, *Proposed Findings as to Certain Aspects of the Coal Mining Industry*, Submitted to the U. S. Coal Commission, July 30, 1923. (Statement verified for its substantial accuracy by representatives of U. S. Geological Survey.)

³ Smith, George Otis, quoted in *Coal Age*, Feb. 6, 1925, p. 221.

many things which either were left out of the ideal picture, or were painted in other colors.

In the first place, the system of arrangements by which the industry is guided are less automatic and more complex than those which lie in the presumptions of competition. To be sure, later statements have tried to take account of this complexity and have done something to make the theory fit the facts. But tributes to the worth of free competition still run largely in terms of the simpler theory. Accordingly, the departures from the control of a business by its lawful owners may justly be regarded as compromises with the pure ideal of free competition. In any event, the nature of the arrangements under which the business units work, needs to be considered. For in spite of repeated assertions to the contrary there is nothing automatic or natural in any system of control. Free enterprise, no less than monopoly or government ownership, is a matter of human arrangements. Control can be traced to its source under any form of organization, and until it has been so traced no one is in a position to explain why the coal industry works as it works.

The corporate form of business organization is dominant. Although the individual firm and the partnership still survive, two-thirds of the mining enterprises are corporations.⁴ But the term corporation covers a multitude of different arrangements, and the word tells little about the real seat of con-

⁴ U. S. Census of Mines and Quarries, 1920, p. 264.

trol. In fact, a number of concerns, nominally corporations, represent little departure from control of a business by the owner-manager. Most of these, like the firms and partnerships, are small undertakings. But one of the largest corporations in the industry until very recently was an individual business in all but name. The owner of a majority of the stock was the dominating personality and the real control of the business centered in that one man. At the other extreme is the corporation, likewise found in the coal industry, in which ownership is almost wholly divorced from management. The stock is widely scattered; there is no dominating stockholder, and the management group, from the president down, are salaried officials, none of whom owns more than a few shares of stock.

Control is not vested exclusively in owners and managers; other groups play a part in directing the business venture, and limit the owners' freedom to run their business as they will. If the corporation leases its land, as more than a third of the companies do,⁵ the landlord may exercise a very real control over the conduct of the mining enterprise. If the landlord be the Pocahontas Coal and Coke Corporation, or the United States Government, for example, he not only must approve, through technicians in his employ, the plan of the mining operation,⁶ but

⁵ Ibid., p. 282.

⁶ Based on statement of an engineer who has worked for the Pocahontas Coal and Coke Corporation, and on U. S. Bureau of

through supervision must see that the plans do not become mere scraps of paper.

Nor is the control of the investment banker of negligible importance. In many companies borrowed funds form a large part of the working capital; many companies have to be rescued from bankruptcy by reorganizations in which the bankers play an important role. These concerns must make such terms with the money lenders as the money lenders impose. Conditions imposed by the bankers often account for the selection of the executive personnel, and have even been known, if hearsay evidence may be believed, to affect the attitude adopted toward collective bargaining,⁷ or the wage rate.⁸

A second departure of the actual control from the ideal of free competition, is in the failure of enlightened self-interest to guide decisions. For enlightened self-interest hardly gets a fair chance in the coal industry. It has first to break through a "cake of custom" thick enough to have been perceived by observers with no special claim to acuteness. It has to make its way against an ignorance that is almost proverbial. In fact, it would be somewhat more accurate to say that custom and ignorance rule coal than to attribute its guidance to enlightened self-interest.

Mines, Operating Regulations to Govern Coal Mining . . . on Leased Lands on the Public Domain.

⁷ Statements made to investigator of U. S. Coal Commission.

⁸ See Cassatt, R. W., "Banker Tells the Coal Industry How to Aid Itself"; *Coal Age*, June 25, 1925.

This ignorance is more persistent than the lack of knowledge on the part of those in the seats of power would indicate. It is due as much or more to the lack of records to guide business judgments. For under conditions of modern industrialism intelligent decisions are impossible without a mass of quantitative data. The state of records in the coal industry, however, has shocked most observers. It is not that records are unknown or that the coal industry has been entirely untouched by the modern "taste exact for faultless fact." Sometimes indeed very elaborate records are kept, but the records have little relation to the judgments to be made. Or in other cases those who keep the records have little idea of their value and make of record keeping a mere ritual in which it makes little difference what is entered, so some entry is made.⁹ Or again, records which might be useful to the person in charge of operation at the mine are kept stowed away in the main office of the corporation in a distant city. Even the financial records are none too well kept and many of the business decisions which turn upon the questions of cost must be made without even approximate knowledge. In spite of recent progress in cost accounting it is a wise operator who knows his own costs, and a much wiser one, with backstairs channels of information, who has more than a very vague knowledge of the costs of his competitors.¹⁰

⁹ U. S. Coal Commission, *Underground Management*.

¹⁰ Federal Trade Commission, *Cost Reports on Coal*; U. S. Coal

The lack of factual data to guide decisions extends to matters of underground management as well. The foreman does not know what the miner has done in a day, the number of props he has set, the amount of water he has bailed, the "clod" he has removed, the track he has laid. He must make some decision about the amount that the worker is to be paid, if some of his work is "dead work," but that decision has to be based in most cases not on facts but on surmises.¹¹

Whether the absence of adequate records is cause or effect, one cannot understand why things are done as they are in coal mining, if he overlooks the dead hand of custom. It explains in large measure the prevalence of room and pillar mining, with comparatively few variations from the pattern of Civil War days. It explains the difference in the "rights" of the workers from one district to the next. It explains many of the inequalities in the wage structure.¹² It accounts for much of the opposition to safety devices by both coal operators and mine workers. It accounts, so exasperated friends of the industry say, for the lack of paint on many of the

Commission, *Cost of Production of Bituminous Coal*; U. S. Coal Commission, *Investment and Profits in the Bituminous Coal Industry*; see also Editorials in *Coal Age*, July 10, 1924, p. 35; July 31, 1924, p. 139.

¹¹U. S. Coal Commission, *Underground Management in Bituminous Coal Mines*, by Thompson, S. E., and Eavenson, H. N.

¹²See Lubin, I., *Miners' Wages and the Cost of Coal*, 1924. (Investigations in Industry and Labor, Institute of Economics, Washington.)

company houses.¹³ The list could be extended indefinitely, but the present point is that such a thick "cake of custom" makes a farce of guidance by enlightened self-interest. For individuals "handcuffed to precedent" will not indulge in a nice weighing of pros and cons.

A third aspect of the compromised control is the tendency toward combination within the industry; for there are trade associations to unite the corporations and a trade union to unite the workers. In spite of the weakness of the trade association as a price controlling organization, its existence in the industry marks a distinct tendency in the direction of centralized control of some aspects of coal mining. Yet in the coal industry even in the tendency to monopoly there is competition; and some persons might see evidence of a divine harmony in the over-expansion of trade associations. Not only is there an association in every district but often there are several, competing for members and for the right to speak for the industry.

The purposes and activities of the associations, and the extent to which they interfere with the individual freedom of the members, vary. They do not exercise a direct control of prices. But they do concern themselves with matters that affect costs and hence indirectly affect prices. The National

¹³ Brosky, A. F., "Coal Industry Has Awakened to the Value of Paint," *Coal Age*, June 19, 1924, p. 901; also Editorial, "Handcuffed to Precedent," in same.

Coal Association carried on an extensive and intensive "educational" campaign on methods of cost-accounting; and many of the local associations have as their main object the negotiation of wage rates with the union, a negotiation which plays an important part in determining labor costs. They protect the interests of the mining corporations before legislative assemblies and fact-finding commissions; they speak for the operators on questions of car distribution, freight rates and the like; some of them even presume to tell an individual operator that he cannot "fire" a given worker. Thus, with all their weakness, they mark a departure from the theoretical picture in which the separate businesses do not co-operate, but only compete.

Combination among the miners has interfered with the freedom of competition more than association among operators. In some districts, to be sure, workers vie with workers in selling their services and corporation bids against corporation for its labor force. But this is true only in about half the coal fields. In the others the workers are organized in the United Mine Workers, and work on the terms agreed upon by representatives of the union and the mine operators. This control by the union not only prevents competition between individuals; it likewise forbids competition between union districts in fixing the terms of the labor contract. For wage negotiations are in the hands of the international organization, and it insists on uniform changes in

tonnage rates, on a standard working day, and on standardized day wages in all districts over which it exercises effective jurisdiction.¹⁴

But the centralization in control does not stop at this point, although beyond this it is a centralization within districts rather than for the unionized fields as a whole. The working conditions and the rights of the miners are determined by district agreements. Although there is some variation from mine to mine, many requirements are standardized. Through the machinery for adjusting disputes the district office of the union is influential in maintaining a labor code which restricts the rights of management in innumerable ways.¹⁵ Thus, the control exercised by the workers is far different from the individual freedom to reject a bad bargain allotted them under free competition.

In the fourth place, external limits to the free exercise of business judgment mark a compromise with the competitive ideal. For groups without the industry, no less than those within, have injected themselves into its control and have meddled with its workings. Other industries, notably the railroads and the steel industry, have not been content to be mere buyers of coal. They have undertaken to control supplies by opening their own mines, producing for their own needs primarily, but selling on the mar-

¹⁴ See Lubin, L. *Miners' Wages and the Cost of Coal*.

¹⁵ U. S. Coal Commission, *Labor Relations in Bituminous Coal Mining*.

ket when their business was dull. The railroads, too, have had control of the extension of facilities to new fields, and of the distribution of cars between various mines. Thus they have been in position to influence the rate and the direction of the expansion of the mining industry.

Nor has the body politic kept its hands off the industry as a good state should. The federal and state governments throw limits around the free exercise of business discretion. There are not only laws that affect all types of business, federal anti-trust laws, and transportation acts, state corporation laws, investment and finance laws, labor laws, truck acts, state transportation laws, but there also are laws applicable to the mining industry alone. In each of the several states in which coal mining is carried on there is a more or less elaborate mining code, designed to secure certain minimum precautions against accidents. The provisions of the codes vary from state to state, but usually they set standards of ventilation, prescribe the precautions to be taken in gaseous mines, set standards of competence for mine foremen, specify the maximum number of men who may work under one foreman, and fix the foreman's duties even to specifying the frequency of his visits to the working places. In some codes there are also elaborate provisions about the equipment required, the construction of the shafts, and the qualifications of the miners.

When full account is taken of the complex organ-

ization of the business unit, of the ill-informed business judgments and the cake of custom by which the industry is guided, of the tendencies to monopoly from within and to restriction from without, perhaps the compromises with free competition are almost as conspicuous as its resemblance to the ideal. But even the compromises do not obscure the pattern of free competition. The most that they do is to blur the lines here and there. For it is characteristic of coal that no compromise extends over the entire industry. It almost seems that some of them succeed in damming up competition in one spot to enable it to break forth with greater virulence in another. Thus trade associations may modify the competitive struggle within a limited area but they actually assist in pitting district against district. The rules governing distribution of railroad cars prevent one enterprise bidding against its neighbors in the amount offered for cars. But since cars are distributed in accordance with capacity, they bring about competition in increasing equipment and labor force. The union succeeds in stifling competition between laborers and between districts over the unionized portion of the industry. But in half the coal fields competition between workers still persists. In fact no compromise extends over enough of the industry to establish uniform standards, fix a plane of competition, or give any unity of control.

The failure to attain complete freedom of competition is not to the discredit of the industry.

Without some compromise it could hardly have run. For it is impossible to embody the abstractions of the theory in working institutions at the present time. The ideal of free enterprise was formulated for a society much simpler than the industrial society of today. But the theory over-simplified the organization even of the society it professed to describe, and took no account of the complexity of the forces which determine conduct. It is inevitable therefore that the control of an industry must depart in some measure from a pure and undefiled system of free competition.

The compromises that have been forced on the industry by external restrictions are evidence of the community's realization that control by competition was inadequate. No one familiar with the current of thought in America when these restrictions were imposed will maintain that restriction for restriction's sake was the order of the day. It was only as the industry failed miserably to do those things which were expected of it, that free competition was interfered with from without.

This does not mean that all the compromises have worked for good. On the contrary, some of them have apparently made a bad matter worse, and have justified the frequent identification of meddling with muddling. The railroads' interference has clearly been of this character. Government regulation of the system of car distribution has been ill conceived. Doubtless some of the activities of the

United Mine Workers have been mischievous. But the lack of skill which has characterized much of the tinkering does not argue that there was no occasion for action. Patients have died ere now from doctors' remedies, but the doctors get little chance at well men. Whatever their effects, the departures remain the abiding witnesses of the failure of a freer competition.

CHAPTER IV

THE SPOTTED ACTUALITY

"How strange," I said to one I saw,
"You quite upset our every law.
However can you get along
So systematically wrong?"

—*The Bab Ballads.*

•I. CHAOS AND ORDER

Free competition or compromised control are but means to an end. The test of organization lies in the results it achieves. Has competition, compromised as it is, made mining a well-run industry, nicely adjusted to its place in the industrial system? Has it given the consumer an uninterrupted supply of good cheap coal? Has it rewarded the investor with a reasonable return after all unnecessary risk has been eliminated? What return has it yielded to the worker? In a word, does the industry realize the promises of the competitive ideal or is the actuality somewhat spotted?

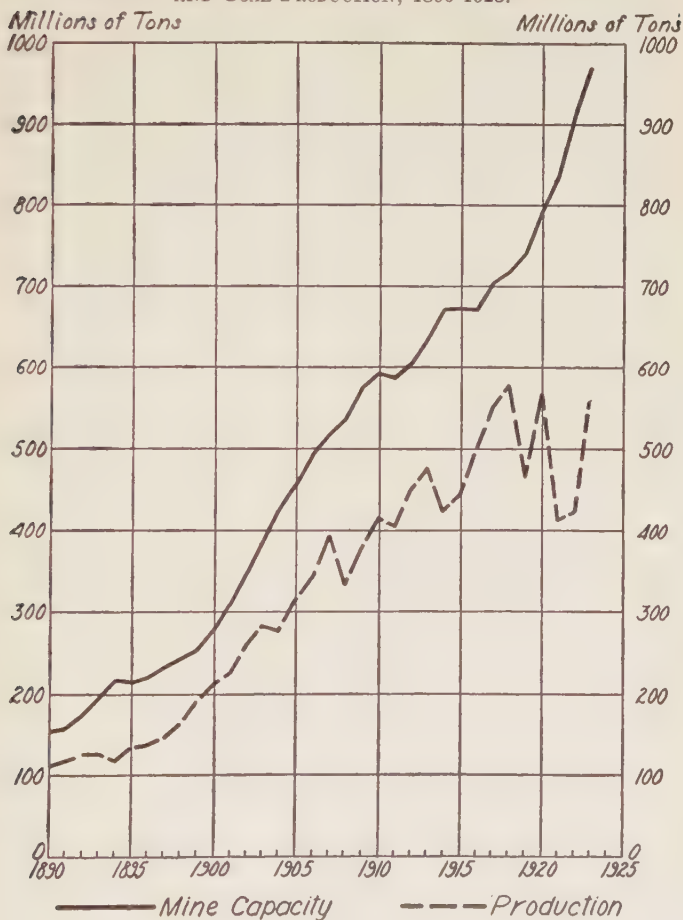
The answers to these questions might be given very briefly. Even a hasty glance at bituminous mining as it is and has been shows more chaos in the elements than competition was supposed to tolerate. An ear need not be very close to the

ground to catch complaints of inadequate returns from investors, laborers, and users of coal. But sweeping generalizations are not answers. Those who doubt may wish to compare performance and promise, chapter by chapter, and verse by verse. All who concern themselves with coal must know in some detail what the present organization of the industry has accomplished.

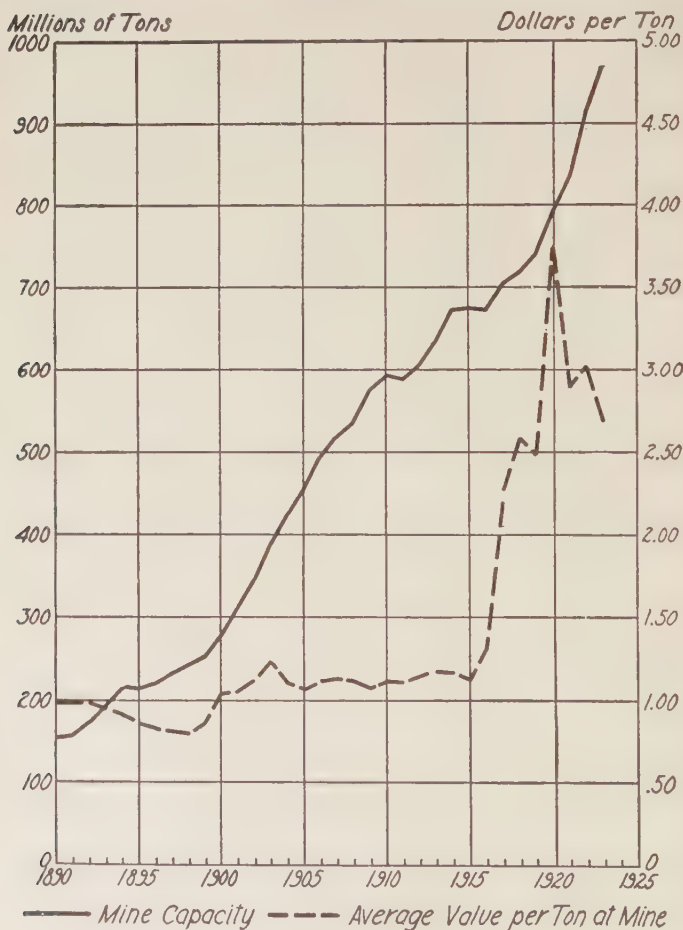
The expected economy and efficiency have not been realized. Coal mining is not co-ordinated with other industries; neither is it thoroughly integrated, composed of just the right number of efficient units; nor is due economy to be found in the work of even the best mines. The adjustment of the capacity of the industry to the demands upon it was left to the price mechanism. To high prices, which were expected to indicate quite accurately the need for expansion, fell the task of calling new mines into existence. Falling prices were supposed to be a signal that mine capacity was too great and should be reduced. Lack of adjustment was to be only a temporary phenomenon.

Actually it has not worked just that way. From 1890 to the present, the industry has at all times stood ready to produce much more coal than the country could use. Year after year the total capacity of the coal mines, that is the tonnage that they would have produced if they had operated steadily,¹

¹ See Appendix A of this book for discussion of estimates of mine "capacity."

DISPARITY BETWEEN INCREASES IN MINE CAPACITY
AND COAL PRODUCTION, 1890-1923.

DISPARITY BETWEEN CHANGES IN PRICE AND MINE CAPACITY,
1890-1923.



was at least a third greater than the actual production; and an excess capacity of 50 per cent of the year's output was no uncommon occurrence. The curves of coal production and mine capacity (see p. 57) suggest a mad race in which production has made no headway in catching up with capacity. The curves of mine capacity and coal prices (see p. 58) show that expansion in capacity was not governed directly by price changes. During periods of falling as well as in times of rising prices the growth of the industry continued unabated.

Those seeking scapegoats place responsibility upon some of the compromises with free competition. They point to the railroads, which have offered inducements to open mines in order that they might increase their coal traffic. They discover that corporations in other industries have opened unneeded mines the better to insure their own coal supply. They indict the union which, by fostering strikes, has encouraged expansion in fields where strikes are under control.² But all these and more are not enough to explain the over-expansion. The very nature of mining makes it difficult if not impossible for rising and falling prices to make the necessary adjustments. A mine once opened is costly to close down. Sometimes closing is even more costly than operating at a loss.³ Hence the expected response

²U. S. Coal Commission, *Relief from Irregular Operation and Overdevelopment*.

³See Shurick, A. T., *Coal Mining Costs*, p. 37-8; see also Clark,

to falling prices is difficult to make. The response to rising prices on the other hand can be made with ease. But it takes some time for the effect to work itself out, and by that time market conditions may have changed.

Nor is this undue response to a rising market to be attributed, as is so generally done, to the village shoemaker, the itinerant preacher, the peripatetic tramp, and other strangers who, in all innocence and without guile, venture amid the unknown perils of coal getting. In a large measure the over-expansion has come from within. For, if the efficiency of the industry had remained constant, the mines in 1920 could not have produced more coal than the country required.⁴ But cutting machines and other improvements have been introduced into mining; and they, as well as the multiplication of mines, have increased the capacity of the industry.

The failure to adjust capacity to demand means that the coal industry has attracted to itself a far larger share of the country's productive resources than it needed for its work, or could support in the style to which they are entitled. On the side of labor its greediness is well known. It uses almost 700,000 men to do the work that certainly 500,000 could do without increasing the average daily output per man. It divides among 700,000 the wage which

J. M., *Economics of Overhead Costs*, for explanation of this seeming paradox.

⁴Computed from figures of the U. S. Geological Survey. See Appendix A of this book.

would not afford luxuries to the smaller group. The waste in materials and equipment is equally great although it is less easy to measure. All the machinery that has gone into thousands of useless mines, all the railway sidings that have been constructed to enable them to operate, all the villages that have been built where no village should be, proclaim the coal industry's continued willingness to absorb an undue share of the national wealth.

Nor has the over-expansion had its bright side. It might be supposed that with the threat of over-production always over its head, each business unit must have sought efficiency with single-hearted devotion. The result should be an industry composed entirely of well run mines, fully abreast of industrial establishments in the use of scientific method. But the actual results are very different. The backward art of mining receives attention in a later chapter.⁵ Here it is sufficient to note what most persons with a casual acquaintance with coal know only too well. Modern methods of quantity production, modern labor saving machinery, modern methods of management are, or until very recently have been, almost unknown even in the best run mines. Even a division of labor which reaps the benefit of that specialization over which distinguished observers grew enthusiastic in 1776 is not to be found.

⁵ See below Chapter VI, "The Rival Arts of Mining."

But not all the mines are as good as the best. The figures on size of mines are clear evidence that most mines are too small for economic operation. To be sure, size is only a rough index of efficiency; but a mine with an annual output of 50,000 or even 100,000 tons can hardly be run as economically as the one with a capacity of half a million tons. Yet in 1922, of the 9,000 mines shipping coal there were only 400 with a production as great as 200,000 tons, while there were 3,800 with an output of 10,000 tons or less. Nor do these small mines occupy an unimportant place in the industry. Two-thirds of the total tonnage in 1922 came from those with an output under 200,000 tons, and a fourth from mines with less than 50,000 tonnage. But even this understates the role of the uneconomic mines; for efficiency is a matter of equipment and of operation as well as of size. To obtain the number of badly run mines we should, were it possible to do so, add large mines poorly equipped and badly managed to the large number whose recorded size bears witness to their inability to produce coal at minimum cost.

If further evidence of differences in efficiency is wanted, it is supplied by various and sundry reports which show "costs of production." A range in a single district from \$1.50 a ton at the lower limit to \$4.50 at the upper limit is not unusual. The "effective" range is narrower, but one from \$2.40 to \$3.00 between the first and third quarters of the

tonnage is very moderate.⁶ There is an accepted alibi for this variation. It is customary to blame it on "nature," thickness of seam, pitch, condition of roof, what not. The alibi is not without plausibility. But curiously enough, the differences between the costs from one district to the next, where natural conditions are known to differ, are no greater than the difference between costs within a district where operating conditions are similar. This suggests that man must share in the responsibility and gives a real significance to the variations in cost.

It was not supposed that competition would permit the continued operation of such a large number of mines below the standards of the best of their competitors. That it should tolerate their existence when the better mines could put out all the coal that is wanted is almost unthinkable. But it has done that very thing. A recent study showed that in Illinois the 84 largest mines could produce a greater tonnage in a year than the 334 mines actually produced in 1923.⁷ They could do this without increasing their daily tonnage, merely by working 300 days in the year.

If competition has not succeeded in weeding out the badly run mines, it has not been because mining enterprises have been immune from bankruptcy. On the contrary, their mortality rate has been high. As

⁶U. S. Coal Commission, *Costs of Production of Bituminous Coal*.

⁷Stewart, Ethelbert, "The Coal Situation in Illinois," *Monthly Labor Review*, May, 1925.

early as 1649 the annals of coal relate that "Master Beamont, a gentleman of great ingenuity and rare parts, adventured into our mines with his thirty thousand pounds. . . . Within a few years he consumed all his money and rode home on his light horse."⁸ Since his time an order of the Knights of Master Beamont could have been founded. And the order would have been large and flourishing although the names of most of the members are unknown to fame. For almost as little account is taken of losses in the coal industry as of losses at the gaming table.

In the absence of adequate records stray bits of evidence sustain the reputation of coal mining as a hazardous venture. In Illinois, for example, in 1914 and 1915, 24 coal companies that had produced a fifth of the state's tonnage, were bankrupt. The majority of them paid nothing to the stockholders, and less than 65 cents on the dollar on the outstanding bonds.⁹ In the Pittsburgh district, in earlier years, the harvest of failures was so large that few companies survived in their original form. The Pittsburgh Coal Company found no difficulty in buying up at the bargain counter a number of nearly defunct corporations.¹⁰

Perhaps bankruptcy after all is not more dis-

⁸ Quoted by Galloway, Robert L., *A History of Coal Mining in Great Britain*, London, 1882, p. 53-4.

⁹ U. S. Senate, 66th Congress, 3d Session, Hearing before the Committee on Manufactures, on Senate Resolution 8429.

¹⁰ Ibid., Testimony of John B. L. Hornberger, Vice-President and Comptroller, Pittsburgh Coal Co., p. 915.

criminating than the rain, and has visited the godly as well as the ungodly. Perhaps its failure to weed out the inefficient may be attributed to machinations of financiers. For bankruptcies have been followed by re-organizations. The business unit has disappeared or been born again; the mines it operated have remained to plague the industry.

In the absence of economy the promised returns are impossible. The plague of bankruptcy which has descended on the industry from time to time has made a farce of the security promised the investor in mining enterprises. But this has not made it impossible to attract funds into the industry. Year after year investment funds have flowed into coal mining, even to enable it to do those things which it should not have done. Thus many corporations have been able to buy up coal reserves not destined for exploitation in the present century.

Nor is it clear that the profits of those who did succeed were high enough to compensate for the losses of those who failed. In some years to be sure, the returns were extravagant. In 1920, 1,059 companies, or almost a third of the 3,541 reporting for income tax purposes, had profits of 50 per cent or more, and 498, or about a seventh, reported returns of 100 per cent. But the next year told a very different story, while any long run tendency is shrouded in the darkness of business mysteries. Scraps of evidence, however, indicate that over a period of years many who avoided loss had only

very moderate gain.¹¹ The investor in a mining enterprise did not buy a ticket in a lottery, assuring him a big prize if he won at all. He stood a gambler's chance of losing his all, winning vast wealth, or receiving a return not unlike the return his more cautious neighbors reaped from seasoned investments.

II. THE HARVEST OF FIGS AND THISTLES

The consumers have not reaped the harvest that competition was expected to yield; but they have had enough to live within sight of the promised land. On the whole the industry has honored the promise of an ample coal supply. Perhaps it has honored it not wisely but too well. The consumer has not been compelled to exercise even reasonable foresight as to his needs, but has been able to call for coal and have it appear almost immediately. Consequently he has had little incentive to rid his demand of caprice or to consider the burden that his fickleness throws upon the industry. But it was not nominated in the bond that the consumer should be considerate. Considerate or whimsical he was to be served. By and large, he has been served, and has had no occasion to complain of lack of coal.

But there has been a fly in the ointment. Emergencies have occurred in which the coal supply was

¹¹ See U. S. Coal Commission, *Investments and Profits of Bituminous Coal Operators*. See also Tryon, F. G., and Hale, S. A., *Coal in 1922*, p. 556.

threatened; in 1917 with our entrance into the war, in 1919, and again in 1922 with production suspended over a large part of the coal fields, the consumer saw his coal supply in danger. He could no longer be assured of coal merely by exercising his royal prerogative of demand. He had to get out and "hustle," and even to call upon the government for assistance. Usually in some way or other coal came, but during the War, some industries had their supply restricted and coalless Mondays, improperly called "heatless," were not unknown. Except for such emergencies, however, the user of coal has had all he wanted when he wanted it. But the ability to meet just such emergencies may well be the real test of the adequacy of the existing organization.

The quality of the coal that the consumer has received is somewhat uncertain. The protection that the present organization of the industry affords lies in its ability to mine more coal than is wanted. Hence it offers a wide range of choice. But the array of coals is somewhat bewildering, for the marketing of coal as well as its mining is a backward art. Coal is not sold in terms of its heating properties, B.t.u.'s, ash, carbon content, but under trade names which either by accident or design conceal rather more than they tell of its real quality.¹² Under such conditions, if the buyer gets coal adapted to his

¹² See for example, U. S. Federal Trade Commission: *Federal Trade Commission v. Interstate Fuel Co., and White Ash Coal Company*, Docket 1074.

needs it is due to chance, or to the outcome of a costly process of trial and error. Usually perhaps his coal is free from the grosser impurities; but in times of scarcity, "fire proof" coal is sold at fabulous prices.¹³

But to many, coal is coal, and quality is less important than the prices to be paid. The facts about prices and costs have been too well concealed to permit of accurate comparisons between the actual and the expected results of competition. Enough has leaked out, however, to make it clear that competition has not kept the faith. The buyers of coal have some grounds of complaint on the score of prices.

The outstanding fact about coal prices is their infinite variety. There are different prices for coals that differ in kind, or in name, or are taken from different mines. There are also different prices to different consumers for coal from the same mine. For a "one price" policy is too modern an invention to have made much headway in the world of coal. In general, too, there is a difference between the price of "contract" coal, which is produced to order, and "spot" coal, which is mined and then sold.

This variety of prices is not a part of the picture champions of competition have painted. To be sure, differences in prices should exist, but in theory

¹³ See U. S. Senate, 66th Congress, 3d Session (1921), Hearings before the Committee on Manufactures, on Senate Resolution 4828, p. 30.

they should be easily accounted for in terms of the quality of the coal or other equivalent realities. In fact, differences in prices correspond only very roughly with differences in quality. One company, for example, may sell the greater part of its coal on long time contracts, while another sells most of its production from day to day on the "spot" market. If the market is good, spot coal may be dearer than contract for almost the whole year, and hence that operator's coal is dearer than his neighbors. Or one operator sells to the railroads who have demanded cheap coal in return for preferred service in cars, while another sells to concerns who have nothing to offer but money. Another corporation which has built up good will by living up to its contracts when others were cancelling theirs, may later be able to reap the reward of its self-control in prices higher than its neighbors can charge. Another may have built up the same good will by "putting imagination into its salesmanship," and its coal may command higher prices than similar coal with wrappings of less attractive phrases. For the factors that keep the consumer from always getting the best quality also compel him sometimes to pay more for worse coal.

Competition has not been more successful in bringing about the expected decrease in prices, as is shown in the chart on p. 58. Prior to 1915 to be sure there was little evidence of a general movement upward. From 1900 to 1915, coal prices increased

more slowly than prices in general. From 1915 on, however, the price rose rapidly and reached the high point of \$3.75 in 1920. This increase was greater than the general price increase for the period. On the basis of 1913 prices, the index number for agricultural products for 1920 was 255 and for producers' goods in general 215, while the index for coal was 318. Since 1920 to be sure the general trend has been downward; but neither in the depression of 1921 nor in the years that followed did the price get back to its pre-war level, measured in terms of dollars or of purchasing power.¹⁴

Nor can the failure to bring increasing cheapness be attributed to increasing natural difficulties which imposed higher costs. The truth is that the new coal fields which have been opened have easier mining conditions than those which were mined first. We are still using the cream of our deposits, and no obstacles have been imposed by nature to an ever falling price curve.

Reference to the chart on p. 58 will show too that competition has succeeded only passably well in maintaining stability of prices. Before the War, the fluctuations in average yearly prices were not very violent. Since 1916, however, the vacillations have been more marked. A rise from \$1.32 in 1916 to

¹⁴ The index for coal for 1923 was 227; that for all commodities was 154. Coal values for 1924 are not yet available; the spot price index, however, was above 160, while the index for all commodities was 159. For coal price figures see Appendix A of this book. Commodity price indices are for wholesale prices and are from the Federal Reserve Bulletin.

\$3.75 in 1920, a drop in 1921 to \$2.89 and a return to \$3.02 in the following year is hardly compatible with the stability which competition was supposed to bring. But this does not measure the full extent of the fluctuations. From month to month within the same year prices have risen and fallen as much as from year to year. "Spot" prices have moved even more rapidly. The rise during 1920 from \$2.51 in January to \$9.51 in August is too great to be dismissed as merely a result of the business cycle.

Strange as it may appear, these price changes did not automatically bring their own corrective, forcing changes in the amount of coal demanded or the supply offered. On the contrary, if a change in the price of coal had any effect on demand and supply it appears to have been in the wrong direction. As coal shortages started prices skyward, the madder became the buyers' scramble for coal, and curiously enough less rather than more coal was offered for sale.¹⁵ On the other hand, when prices started downward, this discouraged rather than stimulated demand, and increased rather than decreased the amount of coal offered on the market. Buyers waited for prices to fall still more and mining corporations tried to reduce overhead by increasing production. These are short time phenomena, but the longer fluctuations show the same results in less

¹⁵ Due to the opening of small mines and the wider distribution of car supply which decreased the railroad's ability to get coal to market.

extreme form. In years of high prices much coal was sold, in years of low prices relatively less; a year of high prices often meant a succeeding year when coal was dearer, while cheapness followed a year of cheapness.

This suggests that neither the supply of coal nor the price it commands is determined by the necessary costs of production. But the exact relation between costs and prices is hard to ascertain. For if the business unit which mines the coal does not know its own costs, what chance is there for mere outsiders to know more? To be sure various intrepid investigators armed with governmental authority have attempted this difficult feat. But their temerity has not resulted in throwing much light upon the prevailing darkness.

One thing, however, is demonstrated beyond dispute. Movements of prices have run far ahead of changes in costs; and the rate of profits has shown wide fluctuations from one year to the next. The profits of 1920 have already been mentioned. They afforded such an extravagant percentage upon investment that those who use words none too nicely have been led to talk of "profiteering." In 1921, however, costs had not decreased, but for many mining corporations profits were but a memory. Fully a third of the coal companies reporting for income tax purposes were able to report a loss. Very few had to report profits of 25 per cent or more, a rate of return which would have appeared "very

moderate" in 1920.¹⁶ This suggests that prices in any given year bear little relation to the cost of production. In a good year for the coal industry the price is exceedingly dear. It covers the actual costs of mining, at least those that the corporation, with the help of the Treasury, discerns, and yields a more than handsome profit for most companies. In a bad year, the price fails to cover the actual costs of many enterprises which will remain in business, and yields a profit to very few.

But perhaps this lack of relation between prices and costs does not mark a failure to realize the promise of competition. For the promise does not run in terms of prices at any given time nor from year to year but in terms of an indefinable "long run." It runs in terms not of costs incurred but of necessary costs. Unfortunately, however, for attempts at statistical verification of the promises, price, cost, and profit figures take no account of these abstractions. They can be translated neither into the categories of the schools nor into the presumptions of common sense. From our knowledge of mining, it is safe to assume that actual costs are greater than necessary costs. Even if some expenses deemed necessary were incurred, such as those involved in adequate safety precautions, reductions due to the elimination of needless waste would be more than an offset. But about the relation between

¹⁶ U. S. Coal Commission, *Investment and Profits of Bituminous Coal Operators*.

temporal and long-run prices even a guess is impossible.

Buyers, however, are more interested in realities than in abstractions. Their objection to coal prices is that in dear years they have not been on speaking terms with costs. Nor do they withdraw their complaint when it is pointed out that in lean years prices actually fall below cost. Until the coal industry can show that its costs are not swelled by gross inefficiency it has no ground for complaint if prices never cover costs. For it is not written that the inefficient should prosper.

Generations of consumers yet unborn may charge the present coal industry with carelessness. It has not protected their interests with even the diligence that was expected. In some ways, to be sure, it has been better than the promises of a competitive regime. It has not confined itself to mining the best coal, leaving only the less desirable for future generations. Instead, seams that are thick, and seams that are thin, those with faults and those without, are all mined today, although the requisite supply could be obtained from the better seams.

In other respects, however, the present order has inexcusably neglected the interests of the future. It has left coal in the ground which could have been taken out. This is permanently lost, or can be recovered only with great difficulties, at an almost prohibitive cost. Some of the coal left in the ground serves a purpose, supporting the overlying land for

example; some could be recovered only at undue risk of life; some loss is chargeable to the system of private property and the necessity of leaving barriers between different workings; much must be charged up to ignorance, customary methods of mining, royalty systems, wage structures, and the like. It has recently been estimated that one-fourth of the coal is left underground, and that, with present technical knowledge, more than half of this could be removed at a profit.¹⁷ Wanton waste of this nature was no part of the competitive ideal.

III. THE LABORER'S HIRE

The workers have even more reason to be dissatisfied with the results of the competitive regime in the coal industry. Possibly the contrast between the actuality and the ideal is no greater from the point of view of the laborer than from that of the consumer. But the industry's failure to keep the faith affects the workers more seriously. Coal is one item among many in the budget of the consumer; it is the most important factor in the lives of the miners. Their charge against the present organization of the coal industry is that it has failed to give them the means to a good life.

Doubtless in a world of scarcity complete satisfaction of all their claims is impossible. But in many ways coal has fallen behind other industries in

¹⁷ U. S. Coal Commission, *Amount and Nature of Losses in Bituminous Coal Mining in the Eastern United States*.

the returns it yields to the workers. Whether or not on the whole the lives of the coal miners have been much less satisfactory than those of industrial workers generally is in part a matter of judgment. But it is somewhat beside the point. The workers' charge is that under the reign of competition, mining has not yielded the returns that the state of the industrial arts, and the wealth of the coal deposits make possible. They can point to the strange contrast between high labor costs and low standards of living as evidence that something is wrong with the organization of the industry. Such is the general complaint of the miners. But their charges pass readily from the general to the particular and are substantiated by an examination of the individual items in the indictment.

The security which the worker demands and competition was supposed to bring has been very imperfectly realized. Mining is today among the most hazardous of occupations in the country.¹⁸ Very nearly 2,000 miners are killed annually in the course of their employment, and it is estimated that the total number of non-fatal injuries runs between 50,000 and 150,000 per year.¹⁹ The high death rate is not due entirely to the natural hazards of the trade which man is powerless to prevent. The Bureau of

¹⁸ U. S. Bureau of Mines, *Mine Accident Statistics*, by W. W. Adams, September, 1924, Serial No. 2641, p. 6.

¹⁹ The lower figure was obtained from estimates of the U. S. Coal Commission, and is based on the experience of the Pennsylvania Compensation and Inspection Bureau. The higher figure is based on the experience of the metal mines, and was obtained by a method suggested by officials of the U. S. Bureau of Mines.

Mines estimates very conservatively that at least half of the annual deaths could be prevented if proper precautions were taken.²⁰ Foreign experience bears out this conclusion, for the fatality rate in the American coal industry is higher than that of European countries. The average rate here of 4.08 per 1,000 full time workers is more than three times the rate of 1.13²¹ which is Great Britain's average for the same period.

Nor does the fact that the lives lost per million tons of coal mined is somewhat less here than there improve the picture as much as some would like to have us believe. The output per worker is larger in the United States, partly because of the greater use of machinery, but partly because of more favorable natural conditions. This means that we can secure our coal supply at a lower cost of human lives, even without taking adequate care to protect the workers. With proper precautions we could secure it at an even lower cost. The difference in fatality rates per 1,000 full time workers in American and British mining is a fair measure of the relative efficiency of the two industries in making the mines safe for the workers.

All too little is known about the effect of mining on health, and the relative standing of mining and other industries in this respect. Scattered bits of fragmentary evidence seem to indicate that mining

²⁰ U. S. Bureau of Mines, *Coal Mine Fatalities in the United States and Europe*, by W. W. Adams, Serial No. 2592, April, 1924, p. 1.

²¹ U. S. Coal Commission, *Safety in Bituminous Coal Mining*.

carries no greater hazard than other occupations. Miners' asthma and non-tubercular diseases of the lungs, however, are more prevalent among coal miners than among other workers.²² But the evidence is too slight to warrant more than the most tentative conclusions. The actuality at this point may be as white as the ideal itself. Further knowledge, however, may reveal another spot.

The industry's failure to provide regular employment is all too clear. Even though "firing" is an art little understood, and reduction of the working force in dull seasons is contrary to custom, few miners have an opportunity to work 300 days in the year. When the mine operates, the worker is fairly sure of his job. But few mines work regularly throughout the year. Some close down entirely for a period of weeks or months when no business is to be had. Others work two or three days a week as long as any orders are forthcoming. In the 10 years from 1910 to 1921, the working time of the mines averaged only 214 days a year. While there are always some men who work more days than the average, there are also many who work less. Moreover every year is not so good as the average; in a bad year, such as 1921, less than a tenth of the workers had an opportunity to work 215 days.²³

²² U. S. Coal Commission, *Safety in Bituminous Coal Mining*. See Appendix A of this book for other references on miners' health.

²³ U. S. Coal Commission, *Irregularity of Employment, Attend-*

The miner's claim to wages is second only to his claim to security. His wages must do two things. They must provide the basis for a living, and, according to the presumptions of competition, they must compensate him by a differential for other claims inadequately satisfied. As a basis for a good living, wages in the coal industry are unsatisfactory. Employment as irregular and uncertain as it is in coal mining brings fluctuating and uncertain income. The family's needs for food and shelter must be met regularly, and they can be foreseen with reasonable accuracy. But the amount the pay envelope will contain defies calculation. It may provide the fat of the land one week, or for months in succession, while in the following weeks it will not keep the wolf from the door. Nor is the irregularity confined within a calendar or fiscal year. One year's earnings may be no more like the next than one pay envelope is like its successor. Clearly such incomes would give the housewife an impossible task even though the average income over a period of years were sufficient for decent living.

But the miners' yearly incomes are apparently none too adequate. Rough estimates, which are all that can be secured, indicate that if a miner worked the number of days that the industry formerly averaged, and earned the average wage at the

ance and Absenteeism in the Coal Industry, by H. B. Drury. See Appendix A of this book, "Statistical Summary," for detailed figures.

present union scale, he would earn between \$1,800 and \$2,000 in a year.²⁴ Even this wage would not provide the budget formulated by the Bureau of Labor Statistics to cover the minimum requirements of "health and decency." But such an average is an abstraction without much meaning in the lives of the mine workers. Probably very few of them have earned any such amount year after year, and surely not many have even averaged that, taking good years with bad.

The best evidence of actual earnings for an entire year confirms this conclusion. To be sure it is for 1921, a dull year in which the days of mine operation averaged only 149, and it covers only workers in mines that worked every pay period. That is, it includes only about half the workers, those fortunate enough to be employed in the more regular mines. In that year, less than one fourth of these miners earned as much as \$1,800 and not more than 60 per cent earned as much as \$1,200.²⁵ The earnings of the less fortunate group of miners must have been far below even these figures.

The competitive order, however, does not promise wages sufficient for a decent living. It only promises to the coal miners wages comparable with those of "similar" workers in other industries. The test of its performance is not easy to make because the promise

²⁴ Drury, H. B., "Wages in the Coal Industry," *Annals of the American Academy of Political and Social Science*, January, 1924.

²⁵ U. S. Coal Commission, *Earnings of Bituminous Miners*.

is itself conditional on "other things being equal" which are not equal. Moreover, information about what other workers earn in a year is notoriously inadequate. A recent analysis of the best of the available data indicates that the mine workers in a fairly good year earn more than the lowest paid wage earners in other industries, such as laborers, helpers, and apprentices in the railroad shops. But they earn less than the highly paid, such as the train service employees, engineers, conductors, and firemen, and about the same as the blacksmiths, moulders, and machinists in the shops, or the piece workers in the Chicago clothing market. In other words by ignoring the other things which may or may not be equal, a fair case could be made that earnings in the coal industry in a good year were comparable with earnings in other industries.²⁶

The compensation that the wages offer for an imperfect satisfaction of other claims is even more difficult to measure. In so far as annual earnings of miners are comparable with earnings of similar workers more regularly employed it may be maintained that they do offer compensation for the irregularity of employment. But then what becomes of the additional payment which the miner might claim as compensation for the extra risks he runs? To be sure these risks may be paid for in other ways. If, by workmen's compensation laws or other ar-

²⁶ Drury, H. B., "Wages in the Coal Industry," *Annals of the American Academy of Political and Social Science*, January, 1924.

rangements, the injured workman or his family receives an income comparable to his earnings during the time when his wages are not forthcoming, the pay envelope need not include an amount to cover insurance. But this is a purely hypothetical case. Workmen's compensation acts decorate the statute books of most, not all, of the states in which mining is carried on, but at best they provide very inadequate income for injured workers or their families. In Pennsylvania, for example, a state not the most niggardly, compensation for fatal accidents averages less than \$3,000.²⁷ Accordingly, if it is to offer financial protection to the miner and his family for his work in a hazardous trade, the wage must carry an allowance for insurance. It is only by insisting that the miner be compared with the lowest grade of unskilled workmen that any evidence can be found that his wage carries a differential to compensate for both irregular employment and the risk of injury. Except to laboring "economists" who toiled for the Bituminous Operators Special Committee, this comparison is absurd.

One other departure from the promises is found in the miners' wages. They fail to secure equality between man and man, or to reward the superior worker with a higher wage. The theory of competition is very clear on this point; the better worker must have the better wage. But in coal mining, although differences in wages exist in abun-

²⁷ Downey, E. H., *Workmen's Compensation*, 1924, pp. 150, ff.

dance, they are for the most part to be explained in terms that take no account of individual differences. Some of them, those between union and non-union wages, are due to the better bargaining ability of the workers when acting collectively than when acting as individuals. Some may be traced to the theory of competitive equality which has been accepted as a basis for rate differentials in the union fields. This is an attempt to equalize competitive opportunities between different operators through the wage scale. It gives an advantage to the worker in a mine with more favorable natural conditions and forces part of the burden of carrying the industry on those less fortunately placed. Thus differences in wages are performing the function that books on economics assign to differences in royalties. Other differences are historical accidents which have been perpetuated by the dead hand of custom. On the whole the present wage structure is honeycombed with inequalities incompatible with the theory of competition, and indefensible as matters of abstract justice.²⁸

The miner's wage is important in determining the quality of his life because he lives in a pecuniary organization of society, in which most things that make life worth living are bought and sold in the market. But what his wage will buy depends very largely on the community in which he must live and the opportunities for satisfactory expenditure which

²⁸ Lubin, I., *Miners' Wages and the Cost of Coal*.

it offers. Moreover some things that determine even the material conditions of life are not bought. They come as free gifts of the gods, or more accurately, are supplied by the community as free income. Consequently the mining communities exert almost as great an influence as the money wage upon the lives of the miners.

The promises of the competitive ideal for the mining town are not rich in content. One mining community cannot be worse than another, nor can the mining town be worse than the industrial center, unless these disadvantages are paid for by higher wages, shorter hours, or other compensations. This is a delightful paradox, worthy of abstract logic. Wages shall be high or hours short in a community that offers little chance to spend money and nothing to make leisure either enjoyable or profitable. But in towns where money and leisure spell opportunity, wages shall be low and hours long. There is little in the existing order that corresponds with this ideal. There are many kinds of mining communities, from the "model town" to the disgraceful "camp" of houses "chucked helter skelter together against the tippie."²⁹ While miners' earnings do vary from town to town, there is no discoverable correlation by which high earnings and bad living conditions are found together. But as the ideal itself is hardly to be desired, non-conformity is not a very serious indictment of the present order.

²⁹ U. S. Coal Commission, *Final Report*.

It is serious, however, that under present conditions most miners find it necessary to live in towns or villages that, judged by modern community standards, are extremely backward. In fact in many of them money cannot buy those things which in a city are regarded as the indispensable minimum for decent living. Milk from "the dirty one cow dairy" ³⁰ is all that is to be had in many mining towns. Clean water is often as hard to get as clean milk. Even in towns with a central water supply the water is often of doubtful purity. In many villages, however, the water comes from wells or springs located too close to sources of contamination for safety. Sewerage systems are few in the mining villages. In the words of the Coal Commission, "There can be no doubt of the general backwardness of the mining communities in the disposal of human excreta." ³¹

Many of the houses in which the miners must live are unspeakably bad. The prevailing type in the majority of communities is the house built of wood, finished outside with weather board nailed directly to the frame, roof of composition paper, post foundation, no cellar. Not only are the houses poorly built, but they are often in disrepair. It is impossible to exaggerate the conditions in the worst communities and indeed it is impossible to describe

³⁰ U. S. Coal Commission, Final Report.

³¹ U. S. Coal Commission, *Bituminous Mine Workers and Their Homes*,

them. For "words cannot portray the atmosphere of abandoned dejection or reproduce the smells. Old, unpainted board and batten houses,— batten going or gone and boards fast following, roofs broken, porches staggering, steps sagging, a riot of rubbish and medley of odors." ³² These are descriptive of the worst communities. They are not general throughout the coal fields, but they are numerous enough to blacken the industry.

Even in the better communities there is little variety in the houses and it is almost impossible to get a house with adequate accommodation for a family of five. Modern sanitary conveniences are usually lacking. Houses with baths are almost unknown. Houses with inside flush toilets are only slightly more common, and even houses with running water inside are less common than houses to which all water must be carried from a pump or spigot outside. In short, in most of the mining communities a standard of living even on the material side in harmony with current conventions of what is necessary for "health and decency" is impossible.

Nor does the competitive regime offer the worker a life rich in intangibles to compensate for the niggardliness with which it has distributed material rewards. The miners' work is hard, dirty, carried on underground in the dark, in isolation except

³² U. S. Coal Commission, *Bituminous Mine Workers and Their Homes*.

for a single companion. Its advantages consist of hours that are reasonably short, as hours go, of leisure on the job, and of a greater independence than many industrial workers enjoy.³³ While it is always difficult to compare one job with another, there is slight reason to believe that, judged by accepted standards, the work of mining is easier or ranks higher in its attractions than other employments.

Opportunities for culture and development are very limited.³⁴ To be sure the miner has an abundance of leisure due to his irregular employment; but it is leisure which is so irregular and uncertain that constructive use of it is very difficult. And the mining towns offer little incentive or little opportunity to put it to good use. The miner must depend on his own resources. Most communities have neither evening schools, libraries, nor reading rooms. The Bituminous Operators themselves counted only 62 "accessible" evening schools, 63 free libraries, and 47 reading rooms in 261 communities.³⁵

³³ Goodrich, Carter, *The Miner's Freedom*.

³⁴ Statements based largely on U. S. Coal Commission, *Bituminous Mine Workers and Their Homes*. Also, individual reports of investigators to the Coal Commission and personal observation. See also, Report of U. S. Immigration Commission, 1909, Vol. VI and VII; and U. S. Children's Bureau, *The Welfare of Children in Bituminous Coal Mining Communities in West Virginia*, Bureau Publication, No. 117.

³⁵ *Living Conditions in the Bituminous Coal Fields*, submitted to the U. S. Coal Commission by the Bituminous Operators Special Committee, Sept. 20, 1923, Table opposite p. 28.

Of less formal provision for culture there is likewise a dearth. In organized fields the union meeting provides contact with one's kind, and gives some training in the conduct of affairs to those who participate in its discussions. In some districts, moreover, the union has recently attempted more formal ventures in education by the establishment of workers' classes. Even ordinary facilities for wholesome recreation are not abundant. For theaters, if there are any, the movies suffice. Of music there is almost none. A baseball diamond, a pool room, a dance hall sum up the resources of most mining towns.

The towns provide little more for the children than for the men, and even less for the women. Of course most communities provide something in the way of elementary schools, but many of them make no provision for high schools. The elementary schools themselves usually are poorly equipped, the curriculum is limited to the three R's, and the teachers are poorly trained and inexperienced. A recent study of 11 mining towns in West Virginia, for example, showed that 42 of the 71 teachers had no education beyond grammar school.³⁶ Outside of school hours there is little provision for the child. A few towns have playgrounds or parks, but for

³⁶ U. S. Children's Bureau, *The Welfare of Children in Bituminous Coal Mining Communities in West Virginia*, Bureau Publication, No. 117, p. 22, ff. See also U. S. Bureau of Education, *Schools in the Bituminous Coal Regions of the Appalachian Mountains*, 1920, Bulletin No. 21.

the most part the community offers no place to play except the streets, the pool room, or the slack pile.

For the women there is nothing or almost nothing. Where there are co-operative societies they may be encouraged to buy at the store, but they are not urged to take part in the deliberations of the society. They cannot even seek escape from the monotony of the home by industrial employment, for there are no industries in the community to use their services. In short, life in most mining villages offers to the men little outside of their work, offers to the children less than most cities, and offers to the women almost nothing that is stimulating or developing.

The status of the worker, both in the mine and in the community, depends largely on whether he is located in a union or a non-union field. In the union fields the system of collective bargaining in use and the methods worked out for adjusting disputes give him a voice in determining the conditions under which he works and an assured position in the industry. In the non-union fields a few corporations have initiated a system of "workers' representation" which gives him some voice in minor matters;³⁷ but most of the non-union miners have the right only to take or reject that which is handed down from "above." Their status in the

³⁷ Selekman, B. M., and Van Kleek, Mary, *Employees' Representation in Coal Mines*.

industry is not far from the old "master and servant" relationship.³⁸

In the community much the same distinction holds. In the union fields the miner usually lives in an independent town and has all the rights and privileges of citizenship which are enjoyed by workers in any industrial community. If there is any difference between his opportunities and those of his fellow workers, it is that his participation in the affairs of the community is more effective. For the mine workers form the great body of the voters in the community and there are few external groups seeking to capture their votes. Miners as mayors of the towns, council members, administrative officers are not uncommon in the independent mining communities. Even the miners who live in "company" towns in the union fields find their rights and privileges very little abridged. Their participation in the affairs of the community may be through the local union, but it is a participation that is no less active.

In the non-union fields, on the other hand, the company town predominates and most of the workers must live in towns which, in the words of the Bituminous Operators Special Committee, are "owned and administered by the coal operators."³⁹

³⁸ U. S. Coal Commission, *Labor Relations in the Bituminous Coal Industry*.

³⁹ *The Company Town*, submitted to the U. S. Coal Commission by the Bituminous Operators Special Committee, Sept. 8, 1923, p. 5.

The workers, lacking a strong union organization have little chance to participate in the government of the community. The administration lies with the mine superintendent, and the workers' role is one of passive acceptance of things as they are. Even the privilege of making suggestions to be considered by "his betters" is so rare as to cause comment by the spokesmen of the mining corporations.

In the company towns all the legal and economic powers of ownership lie with the mining corporations. Without exceeding the powers which the law gives and the courts award, they can take from the workers all those rights and privileges summed up under the name of civil liberties. How far they do so is another question. Doubtless suppression for suppression's sake is not indulged in. Doubtless, too, in many communities the worker is ordinarily not conscious that he has no civil rights but only those liberties which he enjoys by grace of the coal operator. But when the organizers of the United Mine Workers appear in the neighborhood, the mining corporations use their power of suppression to the utmost limit. The towns are "closed" to agents of the United Mine Workers and any who are suspected of being friendly to their cause. Workers who stop work or who show sympathy with the union are cast from their homes into the streets, for the managers of the corporations consider "the homes the workers occupy just as

much the property of the company as the mines, the pumps, fans, or dynamos.”⁴⁰ The number of mine guards are increased, for “defense” purposes. Public meetings of any kind are forbidden.⁴¹ In short, the managers of the coal corporations take from the workers all those rights of free speech, free assemblage, and free choice of associates, which are an essential part of personal liberty in a society that gives a constitutional guarantee to protect liberty, as well as property.

On all sides, bituminous coal presents a strange contrast between the simplicity of the doctrine of the invisible hand and the confusion of the visible industry. Even under a regime compromised by collusion, custom, and government, the spotted actuality stands out strangely against the pure white of the ideal. In the waste of mining processes, in the lack of co-ordination between tasks, in the irregularity of operation, in the planlessness of devel-

⁴⁰ President of Vinton Collieries, Pa., quoted in *Coal Age*, April 10, 1924, p. 552.

⁴¹ Committee on Coal and Civil Liberties, Zachariah Chafee, Jr., Chairman, *Coal and Civil Liberties*, a report to the U. S. Coal Commission, presented Aug. 11, 1923; see also, Blankenhorn, Heber, *The Strike for Union*, 1923, for facts disclosed by a special investigation made for Governor Pinchot; Lane, Winthrop D., *Civil War in West Virginia*, 1921; *West Virginia Coal Fields*, hearings before Committee on Education and Labor of the U. S. Senate pursuant to Senate Resolution 80, 67th Congress, 1st session, 1921; U. S. Coal Commission, *Civil Rights*; U. S. Coal Commission, *Labor Relations in the Bituminous Industry*; *The Company Town*, submitted to the U. S. Coal Commission by the Bituminous Operators Special Committee, Sept. 8, 1923, pp. 32-37, which admits, while it explains, the practices which constitute violations of civil liberties.

opment, the actual is far from the perfect. Neither workers nor consumers nor investors have been able to draw the promised rewards from an industry in such a state. The failure of free enterprise has touched all who draw their livings from coal mining or look to it for the means of keeping industry going.

CHAPTER V.

THE TECHNICIAN'S PANACEA.

They've a firmly rooted notion
They can cross the Polar Ocean
And they'll find Perpetual Motion
If they can.

—*The Bab Ballads.*

So matters stand in the bituminous coal industry.

But there is no evidence that things are beyond amendment. Many in the industry have taken account of the situation, and others are being compelled to, whether they will or not. Chief among these are the technicians who are concerned with the art of mining. To the engineer the obvious way to make the industry efficient is to bring in the devices and technique of efficiency; the obvious way to obliterate waste is to cart it out boldly. So they would end the disorder which attends the conduct of the industry by the introduction of machinery, engineering, and the ritual of quantity production.

This proposal of the technicians has a peculiar claim to attention. It may or may not be the open sesame to order within the industry; it may or may not be worthy of a place in a more compre-

hensive and more delicate program for setting the world of bituminous to rights. But, those who propose it are in positions of authority; whether we would employ it or not is a closed question. It is enough that it is helping recreate the coal situation; that it is a larger element in the tangle which this inquiry must analyze.

The proposal, most briefly, has been put as "time, competition, and ingenuity."¹ In its terms "competition" is as usual the active agency of order, and "time" the "long run" in which all desirable things will come to pass; since, more specifically, "the cure is to leave the industry alone to correct its condition by the strength of its own constitution."² "Ingenuity" is to be made manifest, not by economists and statesmen who may suggest ways of making the industry more orderly, but by technicians and engineers who are to perfect and introduce new ways of mining. The Secretary of Commerce preaches the "simplification" of mining practices;³ the engineers on the Coal Commission pin their faith to the onward sweep of the machine technique.⁴ The chairman of the engineering standards committee preaches "the gospel of standardization." He calls "nature" the "original efficiency

¹ *Coal Age*, Feb. 26, 1925, p. 316.

² *Ibid.*, May 28, 1925, p. 781.

³ Twelfth Annual Report of the U. S. Secretary of Commerce, Nov. 1, 1924, pp. 12-14.

⁴ U. S. Coal Commission, *Underground Management of Bituminous Coal Mines*, by Thompson, Sanford E., and Eavenson, Howard N.

expert"; notes "the rude, inexorable, and powerful processes" through which by trial and error and ruthless elimination animal forms were evolved; discovers that "babes, guinea pigs, grasshoppers, potato bugs, mosquitoes and dandelions, all strictly according to specifications" are turned out by "quantity production"; and evokes the technician to emulate the great creator by continuing this work with machines and methods underground.⁵ The "best conducted of all trade periodicals," with a different rhetoric, talks of the "mechanization of the mines,"⁶ "resolute modernization," a "new world for the mining man," and the "big change" which "is coming."⁷ It declares that "times are ripe for a radical revision of mining methods";⁸ that "the plough has thrust its sharp edge into the field of industry, it has disturbed the ground, and if the seed is planted a bumper crop of new and better methods may be expected."⁹ Whether "the hill of introduction" has already been "climbed," and "the industry is now coasting down hill with increasing speed"¹⁰ or not, the promise of machine-mining requires an explicit statement.

The promises of "modern methods" to the individual operator seem clear enough. The pages

⁵ Whitney, Albert W., "Standardization," *Fourth Standardization Bulletin* of the American Mining Congress, 1924, pp. 73-4.

⁶ *Coal Age*, May 15, 1924, p. 713.

⁷ *Ibid.*, May 21, 1925, p. 743.

⁸ *Ibid.*, March 12, 1925, p. 388.

⁹ *Ibid.*, March 12, 1925, p. 389.

¹⁰ *Ibid.*, March 12, 1925, p. 389.

of the trade journals¹¹ tell him of new loaders, new types of locomotives, new layouts of mines, new arrangements of track and tipple, new ways of organization. They argue that technical economies are to be found and operating expenses reduced by the introduction of machines. They point out that the rapidity with which mechanical cutters and loaders advance the face permits a concentration of operations and makes superintendence effective. Above all, they show how wastes can be eliminated by tying together standardized processes into a single going operation. Nor do they confine the promise to new mines. While the difficulties incident to the adoption of new methods to old workings are recognized, it is argued that these can all be overcome with intelligence, technical knowledge, and diligence. Thus they preach to the operator "the gospel of the technological bandwagon." If he mounts it, he will eliminate waste, promote economy in operation, reduce costs, and swell his profits.¹² The operator's conversion

¹¹ Particularly *Coal Age*, *Coal Mine Management*, and *Coal Industry*. The last has just been merged with an inferior periodical. All of these, especially *Coal Age*, are efficient organs, well edited, full of interesting matter, and far in the van of the trade both in technical matters and in economic opinion. In an industry in which there is so much to shock one's sense of economy and order, it is a pleasure to pay passing tribute alike to their usefulness and their efficiency.

¹² A typical bit of argument from an intelligent and well-informed quarter runs: "A coal mining man can get pretty much down in the mouth these summer days if he simply sits at home and looks at the 'no bills' rusting to the track down by the quiet tipple. But if he were roaming around . . . he would be sur-

to the creed of efficiency means "the salvation of many a coal property."¹³

To this promise a threat is added. The stress of competition is acute; in an "over-expanded" industry it may become even more severe. In the immediate future the operator who has modernized his methods is a "mud horse" who can keep going through a depression.¹⁴ Available business will go to those who have "pared their operating costs to the quick"; the profits, even of the efficient, "will be determined by the vigilance they exercise in eliminating the last dollar of cost."¹⁵ The way of machine-mining is the straight and narrow path to solvency and profits; the way of "trial and error," of "rule of thumb," of the "serious-minded conscientious guessers,"¹⁶ the primrose path to everlasting ruin. In six words it is "Lower costs per ton or ruin,"¹⁷ or in three, "Modernize or quit."¹⁸

The promises of the new mining to the industry seem as certain as to the individual operator. If, in the pages of proceedings, reports, and journals,

prised and then interested and then enthused over the vast amount of thought and ingenuity that are busily producing new devices and methods for getting out coal cheaply. It is going on everywhere . . . We are well beyond the Kitty Hawk stage of development. Hereafter progress should be rapid. So much cogitating and testing can not fail of ultimate success."—"You'd be Surprised," *Coal Age*, Aug. 14, 1924, p. 209.

¹³ *Mining Congress Journal*, April, 1925, p. 140.

¹⁴ *Coal Age*, May 22, 1924, p. 752.

¹⁵ *Ibid.*, June 1, 1925, p. 1.

¹⁶ McAuliffe, Eugene, *Coal Age*, August 28, 1924, p. 287.

¹⁷ *Mining Congress Journal*, April, 1925, p. 140.

¹⁸ *Coal Age*, May 22, 1924, p. 751.

it is less explicit, it is everywhere apparent in inference and in incidental statement.¹⁹ Here three predictions seem to stand out clearly. The first is that because of the stress of competition and the high initial outlays involved in the installation of cost-saving equipment, "snow-birds" and "fly-by-nights" will be forced out of business. As a result, their tendency to swell mine capacity will cease to be a disturbing influence in the industry. The second is that the mines which remain will be bigger and more concentrated. Because the machine is mightier than the pick, the face will be advanced more rapidly. This will result in a "balanced mine"²⁰ with its processes articulated, and its operations concentrated enough to allow proper oversight. Even though the daily output be greater than even the larger mines know today, there will no longer be impatience with a diffusion of operations resulting in "too much mine."²¹ The third is that there will appear a tendency towards consolidations. The new methods entail a great decrease in direct and a corresponding increase in overhead costs. Expenses, to be kept low, must be spread over a large tonnage, and this demands regu-

¹⁹ In the paragraphs that follow, references are given only for direct quotations. The evidence upon which the statements in the text are based is far too diverse and far too voluminous to be specified. The curious reader cannot escape it in the recent periodical literature concerned with coal.

²⁰ Anderson, Charles E., "Balanced Mines," *Coal Age*, May 1, 1924, p. 637.

²¹ *Ibid.*, May 8, 1924, p. 661.

lar operation. This decree of accountancy can best be met by a grouping of several mines under a single management. Thus it will no longer be necessary to run many mines irregularly when demand is slack. Instead the combination can concentrate its work upon a few production units.²²

Nor can consumers or mine-workers escape the great benefits which modernization must bring. The disappearance of inefficient mines, the increased productivity of those which survive, the elimination of waste, and the reduction of costs are all stuff which competition can turn into a better grade of coal at cheaper prices. The efficient methods of a more articulate industry are certain to bring to the mine-worker "more regular employment" and "far easier work." If wages are affected by "the ability of the industry to pay," laborers should expect more from their services from a competition between efficient establishments than between wasteful ones. Against such possibilities adverse tendencies are of little avail. Even the very demands of union miners may be a spur to operators to increase efficiency that reasonable wages may be paid.

The general promise, therefore, is of profits and solvency to every efficient management; of more regular employment, easier work, and higher wages to the mine-worker; and to the public an industry

²² See specifically *Coal Age*, May 21, 1925, p. 743; May 1, 1924, p. 626.

of diminishing waste and increasing order, of "fewer mining plants and better," of purer coal and lower prices.²³

In spite of such glowing promises, there has recently appeared here and there a note of doubt. A year ago a diligent search through the literature gave universal evidence that those concerned thought the movement was all for good. Now, the apostles of efficiency underground are beginning to suspect that the new devices may have untoward consequences and to wonder what these may prove to be.²⁴ Such suspicions remind us that more often than not an answer is a restatement of a question; that the solution of a technical problem may leave an economic one in its stead.

²³ Ibid., May 1, 1924, p. 626.

²⁴ The clearest statement which thus far the authors have seen is the following: "The glut in coal has been increased by the great advances in the use of mechanical devices. The excess production has caused the operators to increase the productive capacity of their plants so as to reduce costs, and this had a further effect in increasing the glut of coal and in deepening the sag in the price curve." Hall, R. Dawson, "American Mining Congress Draws Many to Cincinnati," *Coal Age*, June 4, 1925, p. 818.

CHAPTER VI

THE RIVAL ARTS OF MINING.

Volcanoes have a splendour that is grim,
And earthquakes only terrify the dolts,
But to him who's scientific
There's nothing that's terrific
In the falling of a flight of thunderbolts!
—*The Mikado.*

I. THE NEW HOPE

Is the new mining a reality, a promise, or a myth? Is the machine process adapted to coal mining? Can quantity production be at home in underground operations? Can system be given to the tangle of activities which sprawl along from the face to the tippie? Has "modern practice" a sound basis in technical theory and engineering practice? These questions must be answered before we can appraise the solution of the coal problem by the efficiency experts; before we can determine how much of a hope or of a threat the new mining holds.

For such questions the superficial evidence is not enough. Here and there one discovers an operator who sees profits in departing from the ways of the fathers. Here and there one encounters a radical

who insists upon applying to the backward art of mining the advanced methods of the "scientific" manager. But such instances are too far from being universal to support glib generalizations. Coal mining is a trade hoary with age, and the rank and file of those who conduct mining operations are still conservatives, accepting without question the established ways of doing things, and taking no conscious thought about waste and efficiency.

It is, therefore, necessary to give an account in some detail of the old mining and the new. Such a comparison is essential to an understanding of the current problem. It seems unnecessary to warn the reader that neither in development nor in current reality do such sharp lines exist; for gradually the new has emerged from the old, and everywhere elements of the two are to be found together. In fact, impending changes, if really they impend, can be understood only against the background of the ancient and honorable craft of coal-getting.

II. THE CRAFT OF COAL GETTING

The "old mining" is a handicraft. It was brought to America from the coal fields of Durham, of Scotland, and of South Wales. There as a definite trade, with its own bundle of tricks, it was gradually developed from an origin lost in antiquity.

Once coals, like manna, could be gathered directly from the surface as need or impulse directed. When the outcropping seams ran into the ground and the

coal-picker followed, he became a miner. For a time his labors were little affected; he cut down the coals in his own crude way; loaded them into buckets, tubs, or wheelbarrows; and carried them into the open. But as the demand increased and the workings were pushed further and further underground, his crude task became more systematic. The workman gave his whole time to the work; the appearance of new conditions of seam and roof taught him caution; and new methods of getting more coal for less human energy came to him.¹ In keeping with these beginnings the quality of the old mining lies in the activities of the man at the face.

The work of the craft miner is like that of the medieval soldier; the individual is everything, the organization nothing. In his own place, in individual combat, he jousts against the forces of nature with coal as his prize. There is none to say when he shall come and go, how he shall protect himself, or with what tactics he shall attack the face. In all such matters he does what is seemly in his own eyes. Even if the fates go against him and "his time comes," there is usually none, or at best only a surviving "buddy," to witness his fall at his far-flung and lonely post.

His real work is to get coal. This involves "undercutting," or driving a wedged-shaped slit with a pick four feet or more inward at the bottom of

¹ For the earlier stages of coal mining, see Galloway, Robert L., *A History of Coal Mining in Great Britain*.

the face; drilling the hole, filling it with powder, and touching off the shot; and loading the coal into receptacles. Other tasks essential to getting the coal are "dead-work" and self protection. Dead-work, varying greatly with the conditions to be met, consists of removing part of the roof or the floor to get height enough in which to work or to get cars in; a second shovelling of coal to get it into cars; bailing the water from the room; and freeing the coal from impurities. Self-protection involves proper spragging and timbering lest the miner be "sniped" by a sudden fall of undercut coal or of the roof.²

At so complicated a round of simple tasks one miner is better than another; eventually better ways of doing things must be discovered. The miner's craft, therefore, lies not in the cleverness of the instruments which he employs, or in the close-knit organization which encompasses him, but in himself. It reposes in the skill with which he uses his tools, in his knowledge of the impinging conditions, and in his resourcefulness in meeting emergencies and in preventing crises. The real craft miner is "a member of a highly specialized trade,—skilled in the manipulation of drills and the use of explosives, trained to observe anything and everything."³

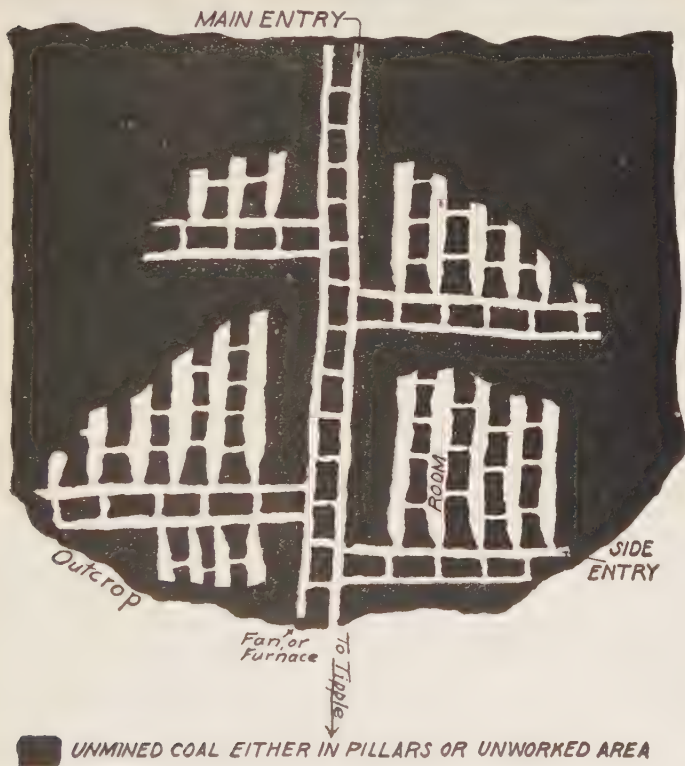
²Jevons, H. S., *The British Coal Trade*, pp. 608-17; Lubin, I., *Miners' Wages and the Cost of Coal*, pp. 25-32.

³Linton, Robert, "Standardizing by North Butte Mining Co.";

The weakness of the old mining lies in the crude organization which envelops the real work of coal getting. From the time when many men had to work in the same mine, some co-operation was necessary and a semblance of order arose. But the system which just grew up was the lack of system itself. The direction of the enterprise fell to an employer, who was an individual of some affluence, or a corporation. The auxiliary tasks, such as pumping, hoisting, track-laying, haulage, ventilation, and the like, came to be done by "company men" working for daily wages. Only the work of breaking down coal and loading it, with the round of incidental tasks involved, was left to the miner. But, with many men working in the mines, it developed upon the management to assign men to working places. More important still, it fell to the management to supervise operations and to plan development.

It was more than chance that the question of development, of placement, and of organization were solved together. The obvious way to develop a mine is to run "mains" from the bottom of the shaft; to lay off, at right angles and at regular intervals, "entries"; and from these to mark off "rooms," right and left, with sizeable "pillars" between. This method, called the "room and pillar" system (See Figure on p. 107) came into existence

SECTION OF MINE WORKED BY PRIMITIVE ROOM AND PILLAR SYSTEM.



with little or no consideration of alternatives.⁴ By many it is still considered the “natural” plan for

⁴For short descriptions of “pillar and room” and “long wall” mining see Lubin, I., *Miners’ Wages and the Cost of Coal*, pp. 14-17. For more detailed accounts consult Moore, E. S., *Coal*, pp. 264-88; “The Long Wall System of Mining,” *The Coal Industry*, April, 1923, pp. 223-4; and Bain, H. Foster, “Modern Methods of Mining Coal,” *Annals of the Iron and Steel Institute*, Oct. 27, 1922.

laying out and developing a mine. It solved the problem of placement by providing "places" for as many miners as the company cared to engage. The separate working places left to the miner at the face the direction of the work. He became, not a regular employee, but a sort of sub-contractor who undertook to mine and load coal at so much per ton. It forced a close analogue to "the tenant farmer system" upon the industry.⁵ This freed the management alike from any real bother about planning or any real concern in organizing the work. The "face," not the organization, was the thing.

As a result there came into vogue a very crude pattern for the development of a mine. Little progress was made in eliminating wastes by modifying the room and pillar system. Development was limited to such minor matters as varying the width of rooms to meet different conditions, reducing the width of pillars to thicknesses just sufficient to keep the roof up, and getting the jump upon sloping seams by varying the angles at which rooms leave the entries. Such minor economies could not offset the costs imposed by a layout in the manner of "catch as catch can." They were of little avail against the increasing expenses attending the wider and wider periphery of the operation. So long, too, as the art of mining lay in the head of the man at the face, organized work was at a discount. Hence, little attempt was made to draw pillars, and huge

⁵ *Coal Industry*, January, 1924, p. 47.

ridges of coal were left underground. These mistakes in development and these oversights became capitalized claims of waste to plague owners with constantly mounting costs.

Nor was economy found in the substitution of the rival system of long-wall mining. Here the floor of the mine is broken into quadrilaterals, or "panels," bounded by mains and entries. Coal is taken along a "long-wall" forming one side of the panel which, as the work continues, is kept at an angle, usually a right angle, to the entry. If the work starts close by the shaft pillar and is driven outward, the method is called "advancing." If, on the contrary, an entry is driven to the edge of the working and coal is taken on the way back, it is termed "retreating."

This system makes good its promise of allowing almost all the coal to be mined. The joker under the advancing system is that the worker has to be protected against breaks in the roof over his head. Under many kinds of roof and in all save very narrow seams, this requires the miner to build behind him pack-walls. Roadways, too, often have to be buttressed. The expense of this dead work, particularly where stone is insufficient and timber has to be used, is very great. The joker, under the retreating system, is that the costs of development are large and unit expenses are likely to prove highest in the early stages of exploitation. As the result the use of long-wall mining of the older type is

limited to narrow seams under well-behaved roofs. Today it has little hold in the bituminous coal mines of America.⁶

The lack of bother over system is typified by the purchase and maintenance of equipment. In the good old days cars were pushed by human beings or drawn by mules to the shaft or to the surface. When modern transport came, purchases were made in a haphazard way. Locomotives were installed without reference to the specific work they had to do; gauges were neither standardized nor related to the volume of coal to be carried; cars of miscellaneous sizes were wastefully strung together for haulage; and, in many cases, rails of different weights and sizes, with many a bad joint, to give adventure and variety to underground transport, were spliced together into a track.⁷ Similar statements can be made about fans,⁸ hoists, boilers,

⁶There are no statistics on the subject of long-wall mining. The statement in the text is based upon estimates furnished by officials of the U. S. Bureau of Mines. Long-wall mining is largely confined to the Illinois, Iowa and the Colorado fields.

⁷U. S. Coal Commission, *Underground Management of Bituminous Coal Mines*, by Thompson, S. E., and Eavenson, H. N.; Stoek, H. H., Fleming, J. R., and Hookin, A. J., *A Study of Coal Mine Haulage in Illinois*; Norman, Fred., "Standardization of Underground Transportation from the Standpoint of the Operator," *Coal Mine Management*, August, 1923, pp. 56-7.

⁸The equipment used for ventilation, which is necessary to carry off noxious gases and explosive coal dust, is frequently only by accident fit for its task. There are even today mines which rely exclusively upon the old-fashioned furnace intended to heat air and start a current in the right direction. See Dunn, Mathias, *A Treatise on the Working and Mining of Collieries*, for an account of early methods of ventilation. See also Moore, E. S., *Coal*, pp. 290-8; *Transactions of the American Institute of Mining and Metallurgical Engineers*, references throughout.

pumps, and the other paraphernalia of coal mining. Units of equipment are not specifically purchased to fit in with the requirements of a forward-looking mining plan. Instead, they are acquired in a casual way, item by item, when the demands of output can no longer be denied.

The organization of haulage repeats the story of equipment. In the old mining the getting of coal is the thing, the getting of it out an incident. The task is just beyond the powers of the manager who has been trained to think of the face as the be-all and the end-all of mining operations. He has never clearly seen that the best results depend upon a careful apportionment of tracks, cars, locomotives, shafts, the tippie capacity, and the like, to each other. Nor has he realized that all of these as a single system must day by day be newly adjusted to the location of the coal and the quantity produced. Instead there is too much capacity at one point and too little at another, improper distribution of cars and unnecessary delays at the shaft, and far too much of hit and miss for "trips" to be on speaking terms with a schedule. There results both a needless waste in management and equipment, and a lack of economy in the use of labor in the extraction of coal.⁹ So, too, the organization of lighting, of pumping, of ventilation, and what not, resolves itself into bundles of unsystematized details.

In such a situation real managerial oversight can-

⁹ See note 7, p. 110.

not develop. Since the tenets of the old mining hold the man at the face to be a craftsman, the idea of supervising his work is an afterthought. In other industries above ground, where work is concentrated and supervision is easy, one foreman to 12 or 20 men is not considered excessive. Underground, where men are working in dark rooms and far apart, one overseer to a hundred or more miners is not uncommon. Here the foreman, who carries in his unindexed head the general knowledge needed by a host of workers, makes a daily round of 16 or more miles. Hence, when he is wanted, he is usually beyond the chance of possible discovery and gives to waste most of the time he is on the wing.¹⁰ Nor is supervision much more effective over the company men. Since indiscipline is contagious, and all who come near are exposed to the pickminer's habit of doing as he "darn pleases," the mine is a poor place for would-be bosses. Each does the task assigned to him as his own habits dictate. Accordingly the task of supervising and correlating different jobs is left to God and goes to the devil.

Nor has the old mining more of a place for the "half-baked youth with boots and a transit" called an engineer.¹¹ Small regard is paid to the technical

¹⁰ See the discussion of "The Mine Foreman and His Problem," in Archbald, Hugh, *The Four Hour Day in Coal*, pp. 35-52. See also U. S. Coal Commission, *Underground Management*, Thompson, S. E., and Eavenson, H. N.

¹¹ Bashore, Charles F., "The Qualifications of a Mine Superintendent," *Coal Industry*, July, 1922, p. 13.

competence of those who plot the extension and plan the introduction of a mine. In the small mines the owners are likely to be self-appointed engineers. In larger ones the industrial problems are not always disentangled from business operations and entrusted to those who can efficiently handle them. Even when engineers are employed, they are likely to apply their knowledge as a ritual rather than seek the methods of production and development which the given set of conditions make economic. At best the technical standards get lost in a shuffle with rule-of-thumb and present necessity.¹²

All of this, without further detail, means that the old mining is a highly developed craft pent in on all sides by an ill-organized assortment of auxiliary tasks. At the face it means shrewd, slow, and interrupted work in getting coal, in the mine it means riotous waste in keeping operations going and in getting coal out. In general it means that the ideal of a compact and economical system producing the requisite coal at the cheapest cost

¹² The following references are typical of the information upon which these statements are based: "Treatment Accorded Young Engineers," *Coal Mine Management*, July, 1923, pp. 29-30; "Foreman Training," *Coal Mine Management*, October, 1923, p. 41; Lowell, Charles E., "Training Future Coal Executives," *Coal Mine Management*, December, 1923, pp. 35, 39, 43; Virgin, R. Z., "The Mine Foreman—The Key Man in the Coal Industry," *Coal Mine Management*, January, 1923, pp. 50, 52, 55; "Functions of Presidents," *Coal Age*, Dec. 20, 1923, p. 910; "Says Coal Mining Needs more Engineers," *Coal Age*, Dec. 27, 1923, p. 962. The reader of coal journals and of other technical literature of coal mining may multiply such evidence to his heart's content.

is lost in the actualities of irregular operation, planless production, and unsystematic development. One is tempted to say that under the fitful sway of the old mining the principal product of the industry is waste and its by-product tons of bituminous. But one must not.

III. THE BACKWARD REVOLUTION

It is surprising that the technical revolution in coal mining is so belated. Until a few years ago the factory system and the production of bituminous seemed to belong to different industrial worlds. Alongside of the steel mill the mine seemed quite destitute of machinery. The wasteful initiative of the pick-miners was in strange contrast to the routine efficiency of the factory worker. Even the despised person who "has never been down a mine" could not easily confuse an ordinary bituminous mine with the Ford automobile factory.

Long ago the coal-mine should have felt the quickening touch of mechanical ingenuity. It was mining which first gave us metal rails; it was mining which helped convert a crude toy into the steam-engine. Many decades ago coal was of importance in causing a revolution in our processes of production; today it supplies the power without which we could not maintain modern industrialism. In sheer volume of product it is one of the great industries; in strategic importance it is one of the two or three basic ones.

The change has been arrested by the isolation of the industry. Coal properties are for the most part removed from urban centers. Through a large number of small and scattered enterprises, in which owners and managers are one, the democratic ideal of diffusion of ownership approaches towards reality. There has been far too little in the way of give and take between operators, and technical societies for the exchange of information have not flourished. Few of the barons, and fewer still of the far more numerous squires, have understood or have attempted to understand the technical processes of other industries.

His isolation has likewise prevented the self-appointed manager of the ordinary mine from appreciating the importance of securing competent persons to lay out mines, to plan production, and to co-ordinate activities. Far too many owners have known of engineering only by hearsay. Far too many managers who profess to be technicians have achieved graduation by the grace of correspondence courses from fly-by-night schools of technology.¹³ Moreover, as a result of scattered holdings, the bulk of mines are too lacking in capital to encourage technical advance and too small in size to afford opportunity to even near-technicians.

Finally, the machine-process is much less at home

¹³ From personal conversations with a number of mining engineers who are acquainted with the bituminous industry. Circulars are to be had from some of these schools. The available evidence seems to indicate that they are prosperous.

in mining than in factory production. It may be that there is only one physical universe, that "the laws of nature are the same everywhere,"¹⁴ and that there can be but one technology. But the machine-process lends itself easily to a routine of production, by which raw materials of uniform quality, by highly standardized methods, are converted into finished products, one unit of which is like another. On the contrary, the art of mining has to contend with coals of various qualities, in seams varied in thickness, and stretching away at different angles. Unlike automobile manufacture, in coal-mining "we cannot bring the work to the mechanism, but have to move the mechanism to the work." In fact, since the face is forever being advanced and the roof forever demands support, "we have a factory which is always demolishing its own walls, and is faced with the herculean task of supporting the load of some hundreds of feet of overburden."¹⁵ Great ingenuity, therefore, is needed to reduce the art of mining to the ritual of a factory performance.

IV. THE TECHNIQUE OF EFFICIENCY

Against the background of craft practice and planless order a new art of mining is developing.

¹⁴ "The laws of nature are the same everywhere; adhesion, cohesion, function, gravity, chemical, electrical, and magnetic phenomena, also human psychology, do not vary in substance from place to place; so there is no reason why the experience of one should not be permitted to bear upon the problems of another." *Coal Age*, Jan. 29, 1925, p. 174.

¹⁵ *Coal Age*, April 23, 1925, p. 602.

Two tendencies, which are aspects of a single movement, threaten to make over coal-mining. One is the reduction of the extraction of coal to a mechanical process. The other is the application of planning to the lay-out, the organization, and the development of mines.

The two things, the machine-process and forward-planning, are kindred expressions of the same idea. A machine is an instrument which has been contrived in such a way as to secure a highly efficient performance of a single act of production. The skill which it possesses is by foresight incorporated into its very design. A succession of machines, properly articulated, makes the mining of coal and its haulage to the tippie a single mechanical process. A plan for a mine is a specification in order of the series of acts which will constitute its development. It involves the reduction of future activities to terms of time and place, of relationship and sequence.

A machine and a plan are alike in that they are both applications of the principle of arranging in advance to secure a given result. They are different in that the order of events is in the one incorporated into a device of metal and in the other into a human organization. They unite in making planning and initiative the function of inventors, superintendents, and managers, and in reducing the actual process of production to a ritual to be performed automatically by the men who do the actual work. A survey of the principal processes involved in coal-

mining will indicate much of what has been and can be done to establish the new mining.

The trend towards quantity production appears first in the undercutting machine. Although the first device for replacing the handpick was patented in 1761, for the better part of a century the contrivance remained merely the evidence of things hoped for. The problems presented to the inventors were very difficult; for in driving its wedged-shaped incision the machine had to contend against the pitch of the seam, the hardness of the coal, the presence of impurities, and the thickness of the deposits. But ingenuity has met the demands, partly by perfecting new devices, partly by developing machines of a variety of types, partly by contriving different kinds of cutting edges.¹⁶

The machines have been successfully adapted both to room and pillar and to long-wall work. They have been used to cut coal in seams which rise at an angle of more than 58°. ¹⁷ They work more quickly than hand-miners and the coal is in general richer in lump and of finer quality. Within 30 years the number of machines has increased from just

¹⁶ For a short history of the development of the undercutting machine see Zern, E. N., "Coal-Cutting Machinery," *The Mining Catalog*, 1922, pp. 797-811. For recent developments, and for the variety of the types of machines, see articles in the recent files of *Coal Age*, and *Coal Industry*, far too numerous to set down here.

¹⁷ Schloss, Charles M., "Steeplly Pitching Coal-Beds," *Coal Age*, March 27, 1924, p. 452. Cornet, F. C., "Cutting Thru and Pitching Coal Seams," *Coal Age*, Dec. 14, 1922, pp. 949-51. Rae, Schloss, and Harrington, "Mining Coal at a 22° Pitch," *Coal Industry*, April, 1923, pp. 193-8.

over 500 to 20,000, and machine-cut tonnage from just over 6,000,000 to more than 300,000,000 tons. At present more than three-fifths of the annual product is undercut by machine.¹⁸

In the sequence of coal-production the next process is loading. The use of human labor to shovel into mine cars 550,000,000 tons of coal a year is a waste that challenges human ingenuity. A technician, with regard only for the mechanics of the operation, calculates that human effort thus applied is only 2½ per cent efficient and is paid at the rate of \$10 per kilowat hour.¹⁹ An ore engineer estimates that the coal we burn in two months would fill the Panama Canal;²⁰ yet in a year our miners use sheer human muscle in loading coal enough to fill it six times over.

The coming of the machine loader bids fair to repeat the story of the machine cutter 30 years later. Its tardiness has been due to the unusual variety of conditions to be met, to difficulties in co-ordinating loading with other operations,²¹ and

¹⁸ U. S. Geological Survey, *Mineral Resources of the United States*, 1921, Part II. Tryon, F. G., and Hale, S. A., *Coal in 1922*, p. 524.

¹⁹ Joy, J. F., "The Substitution of Mechanical Energy for Human Energy in Underground Loading," *Coal Mine Management*, October, 1923, pp. 41-5.

²⁰ Mason, Arthur J., "Comments of an Ore Engineer," *The American Economic Review*, March, 1921, Vol. XI, No. 1, Supplement, p. 107.

²¹ The use of the loader requires a "concentrated car-supply"; the slow work of loading by hand in many rooms meant a "disseminated car supply." Coal men have been rather slow to learn that, if the loader is to be given a chance, the haulage system

to a lack of concerted attention to the problem. Although many devices have come and gone, only recently, if at all, has the experimental stage been successfully passed. At last the market offers to the trade several types of machines adapted to a great variety of mining conditions.²² The list of machines offered to the trade by the equipment houses, however, is incomplete.²³ More than one large company has for some time been quietly experimenting with machines of its own. It has just come out that the "large" loader mentioned in the report of the Coal Commission²⁴ is "Coloder," a machine which a large West Virginia company has been developing since 1893.²⁵ The trade has of late been protesting against keeping new devices

must be made over. See Third Standardization *Bulletin* of the American Mining Congress, 1923, p. 33.

²² For a short history of the development of the loading machine see Zern, E. N., "Underground Coal-Loading Machinery," *The Mining Catalog*, 1922, pp. 853-4. For descriptions of the various machines which have been offered to the trade, see numerous articles in the coal journals and the literature of the companies selling them. For a report of the exhibition of loaders and the discussion of their possibilities at recent coal conference, see The Coal Mining Convention numbers of the *Coal Age*, May 22, 1924, and June 4, 1925.

²³ The best-known are "the Joy digging and loading machine, the Myers-Whaley shovel, the Holmstead loading machine, the Dillig Tractor Loader," the "Stockly Loader," and the "Jeffrey Heading Machine." Mr. Howard N. Eavenson estimates that there have been at one time or another 20 kinds of loading machines. At least three of these have been commercially successful. See *Coal Age*, May 22, 1924, p. 767, and July 24, 1924, p. 115.

²⁴ U. S. Coal Commission, *Underground Management*, by Thompson, S. E., and Eavenson, H. N.

²⁵ Brosky, Alphonse F., "Coloder," in *Coal Age*, Feb. 5, 1925, p. 215.

under cover "until the bugs are removed," ²⁶ and has been calling for a freer exchange of ideas.

Unless some contrivance still more revolutionary appears, the future belongs to the loader. A machine which has been successfully used under the widest variety of conditions ²⁷ and promises to reduce the mine-cost of coal by 30 per cent ²⁸ carries its own recommendation. Technicians are disturbed neither by the relatively small number of loaders in use, ²⁹ nor by the reports of failures. Its meager use is attributed to late development; its

²⁶ *Coal Age*, June 4, 1925, p. 824.

²⁷ For a typical case of the problems encountered in adapting loaders to the peculiar conditions of a mine and of how difficulties can be surmounted see *Coal Age*, Jan. 31, 1924, pp. 163-6. Recent testimony to the successful use of loaders is to be found in articles by various persons in *Coal Age*, July 10, 1924, pp. 37-41; Dec. 18, 1924, pp. 857-63; March 26, 1925, pp. 459-63; June 4, 1925, pp. 824-7.

²⁸ U. S. Coal Commission, *Underground Management*, by Thompson, S. E., and Eavenson, H. N.; also the Committee's Report on Mining and Loading Equipment (Coal Mining Branch) of the American Mining Congress, Fourth Standardization *Bulletin*, 1924, pp. 174-9, gives a table of results from the use of different loaders. A typical case is, "Good Results Secured from Loading Machines," *Coal Industry*, August, 1923, pp. 351-3.

²⁹ Definite figures of the number of loaders in use and of the amount of coal mechanically loaded are not available. The verbal estimates of those who habitually make the rounds of the mines vary greatly. It has been reported by the makers that 200 Joy loaders and 40 Myers-Whaley machines were in use a year ago. See *Coal Age*, May 22, 1924, pp. 767-8. The Pocahontas Fuel Company loaded 1,500,000 tons, or 40 per cent of its total output, with 22 machines in 1924. An editor of *Coal Age* reports a total of 400 machines in use at the beginning of the current year. He says, "sufficient data are available to substantiate a statement that the estimate for 1924 is three or four times that for 1923. Without doubt the machine loaded tonnage for 1925 will be greater than the combined tonnages of all the preceding years."—Brosky, Alphonse F., *Coal Age*, Jan. 15, 1925, p. 67.

shortcomings to the blunders of amateurs. The burden of informed opinion³⁰ is that "mechanical loading is inevitable," and its general application waits upon "the finance and the courage to mechanize."³¹

If the printed page be evidence, modern haulage is rapidly becoming a reality. When 16 mules lack the power of a single storage battery locomotive, animal flesh and blood has been doomed.³² Since 1887, when the first of its kind ventured underground,³³ many locomotives, tending more and more towards a powerful and compact type,³⁴ have entered the mines. It is now common to use engines with trolley-wires for main haulage and storage-battery locomotives for gathering.³⁵ So, too,

³⁰ The technicians, nearly a dozen in all, with whom the authors have discussed the matter at length are agreed that the loader is thoroughly practical. The technical journals see more difficulties ahead than do the trade organs. They are, however, equally enthusiastic in pushing it. It is significant, for instance, that the committee of the American Mining Congress, "anxious to further the development of loading machines in coal mines" insists that "at the present stage of development," "very little can be done towards" their "standardization." Fourth Standardization *Bulletin* of the American Mining Congress, 1924, p. 174.

³¹ *Coal Age*, June 4, 1925, p. 824.

³² Gealy, Edgar J., "Application of Storage-Battery Locomotives to Mining," *Coal Age*, July 26, 1923, p. 129.

³³ Reese, H. L., "Underground Transport," *Coal Mine Management*, November, 1922, p. 31.

³⁴ For descriptions of various types of locomotives see Chadsey, W. R., "Locomotive Haulage," *The Mining Catalog*, 1922, pp. 635-43, and the advertisements adjacent thereto. See also, "Mine Haulage for Thin and Thick Coal Veins," *Mining Congress Journal*, April, 1925, pp. 150-2.

³⁵ Gealy, Edgar J., "Application of Storage-Battery Locomotives to Mining," *Coal Age*, July 26, 1923, pp. 129-132; Boon, E. E., "Factors Governing the Selection of Mine Locomotives," *Coal*

the rule-of-thumb car in its unstandardized form, is giving way to one which is lower, larger, and far more compact. The many cars designed to combine large capacity with low haulage cost form an interesting exhibit.³⁶ One very ingenious car, with solid ends, large capacity, and little leakage can be put through a rotary dump without being uncoupled.³⁷ Wooden rails and cast iron tram plates are being replaced with steel rails of uniform design and weight. Even though a standard gauge cannot be adopted, there is a healthy tendency to make the width of the track meet the demands of economical haulage.³⁸

More startling is the recent development of the conveyor. "Haulage is greatly simplified where there is no necessity of taking cars into working places."³⁹ Conveyors are in frequent use between the face and the entry. Along entries and even along mains it is no longer unusual to find them.

Industry, January, 1923, pp. 80-82; Trautschold, Reginald, "Relative Costs of Storage Battery Locomotives," *Coal Industry*, March, 1923, p. 163-5.

³⁶Zern, E. N., "Mine Cars," *The Mining Catalog*, 1922, pp. 880-9; "Huntington Show I," *Coal Age*, Oct. 19, 1922, pp. 629-30; Crewe, L. C., "Improved Mine Car Decreases Cost," *Coal Age*, Nov. 2, 1922, pp. 704-6; Gillette, G. M., and Reed, J. W., "Changes in Design of Mine Cars," *Coal Age*, Nov. 1, 1923, pp. 655-7.

³⁷Smillie, Sheldon, "The Field for the Rotary Car Dumper," *Coal Industry*, April, 1923, pp. 209-12; Cosley, H. B., "Navajo No. 5 Mine," *Coal Age*, Aug. 16, 1923, pp. 237-45.

³⁸Zern, E. N., "Mine Tracks," *The Mining Catalog*, 1922, pp. 936-9; "Betsy Lane Mine," *Coal Age*, March 1, 1923, pp. 361-6.

³⁹For a comprehensive discussion see Report of Committee on Underground Coal Cutting and Loading Machinery, Third Standardization *Bulletin* of the American Mining Congress, 1923, pp. 136-7.

The three patterns, known to the trade as belt, chain, and shaker conveyors, each of which exists in wide variety, increase the adaptability of mechanical haulage. The method is, of course, better adapted to long wall than to room and pillar mining; the possibilities of economy which they present gives an incentive to mine managers to adopt more modern layouts. The vision of coal flowing without interruption, by means of an articulated system of conveyors, from the face to the tippie, is not beyond realization.⁴⁰ Conveyors are part and parcel of an even more modern method of mining which is to be discussed later.

To tell of the adaptation of modern mining to other underground operations is to repeat many times over this monotonous tale. Fans, hoists, pumps, power plants, tipples, whatnots, have all in their several degrees felt the energizing touch of quantity production. Everywhere the new technique has become apparent; for any process managers may select equipment from a wide variety of offerings.⁴¹ Nor has invention run its course. For

⁴⁰ Dake, Walter M., "Modernize!—Some Revolutionary Suggestions," *Coal Age*, Jan. 24, 1924, pp. 131-5. Mr. Dake was associated with Mr. Sanford E. Thompson in the preparation of the report on "Underground Management in Bituminous Mines" for the United States Coal Commission.

See also *Coal Age*, April 12, 1923, pp. 593-4; April 19, 1923, pp. 631-3; Dec. 20, 1923, pp. 917-21; Oct. 16, 1924; pp. 541-4; Dec. 11, 1924, p. 822; Dec. 25, 1924, pp. 897-905; March 5, 1925, pp. 353-6; May 7, 1925, pp. 675-8; June 4, 1925, pp. 830-2.

⁴¹ See reports of various committees upon "underground transportation," "mine drawing," "mine ventilation," "mine timbers,"

example, in spite of the necessity of pumping two tons of water for every ton of coal raised, it was only three years ago that the first mine installed an automatic centrifugal pumping outfit.⁴² The making of new contrivances points to a day when the industry will no longer exemplify the motto, "Labor conquers all things."

With such changes has come a growing attention to mine development. The layout holds the possibility alike of great economy and of riotous waste. If resources and labor are to be properly used, foresight is essential. Before a new mine is opened, "borings" must be made with a diamond drill, a preliminary survey of conditions be undertaken, and a comprehensive mining plan be drawn up.⁴³ Technicians decide in what order sections of a mine are to be exploited and at what rates of speed faces are to be advanced. This plan finds expression in a series of blueprints, which, in theory at least, are constantly revised to take account of unexpected obstacles and new conditions.

A problem of first importance is to hit upon a method of mining which gives the machines every

and whatnot in the Third and Fourth Standardization *Bulletins* of the American Mining Congress, 1923, 1924, references throughout. See also Roberts, Warren R., "Progress in Standardized and Approved Coal Mine Practice and Equipment," *Mining Congress Journal*, April, 1925, pp. 155-7, 160.

⁴² Gealy, Edgar, "Revolutionizing Mine Pumping," *Coal Age*, Sept. 13, 1923, pp. 392-6.

⁴³ Moore, E. S., *Coal*, pp. 242-50; Rutledge, J. J., "Improved Methods of Working Coal-Mines," *Coal Industry*, January, 1923, p. 48.

opportunity to prove themselves. The first answer is an attempt to adapt the system of room and pillar to the new requirements. This involves great difficulties. Since under this layout coal has to be cut along a short wall, the cutters never really get going. Since cutters and loaders have to be used alternately in the same place, they have to be moved. Unless great care is taken, the dead expense of idleness will eat up the economies which the machines effect. And, if pillars are left underground, the charge of wasteful mining remains.

A single example will indicate the ingenuity with which old methods are being modified to permit the use of new machines. Under the "panel system" (see Figure A on page 127), which is a departure from orthodox procedure, the mining area is cut into rectangular sections, or "panels," bounded by "entries." Rooms are driven by machines across the panel, leaving pillars between. Then, from right to left, or from left to right, the pillars are drawn in proper order. In this operation, the work on the several pillars is so synchronized that at any given moment a straight line, touching the upward and outer corner of the undrawn portion of each pillar, will cut across the panel diagonally. (See Figure B on p. 127.) The object is to control the roof to the end that the break, which is certain to come, will occur behind the working line and over the part of the mine which has been worked out. If careful supervision, aided by maps kept up to date, can keep

FIGURE A. SECTION OF MINE WORKED ON PANEL SYSTEM.

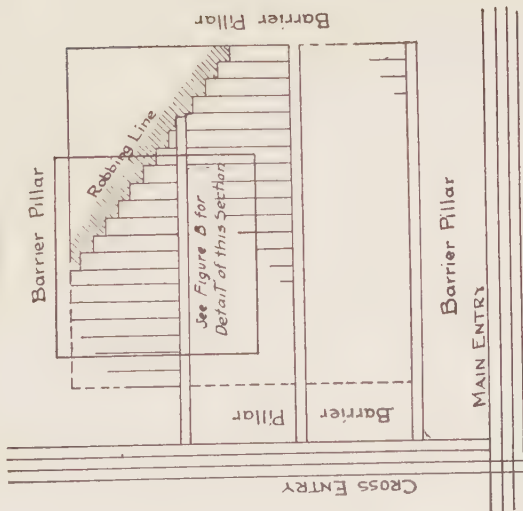
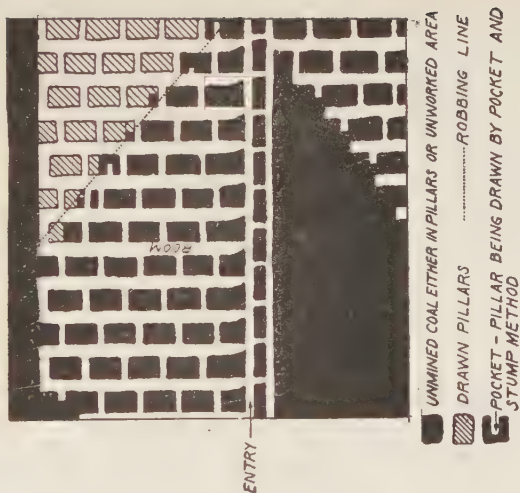


FIGURE B. DETAIL OF FIGURE A.



the work in line, the pillar-drawers, whose work lies back of the line, will be safe.⁴⁴

Under the panel-system machine-mining has proved efficient. The rooms are easily and quickly driven through. Machines can be used to draw the pillars. Since the pressure of the roof, if skillfully employed, will frequently allow the miner to clear the stump with a pick or even only a shovel,⁴⁵ often it is sufficient to undercut no more than half of the coal. This method has permitted as much as 95 per cent of the coal to be taken from the seam.⁴⁶ Thus nearly double the amount of coal may be had from a panel with little increase in many of the expenses involved.

But, even with modifications, the room and pillar system is far from a finality; the contrivances for which it must make a place are new and it is old. It is better for the machines to create a method of

⁴⁴ For drawing pillars an ingenious method, known as "pocket and stump," is frequently employed. First, an incision or a "pocket" is driven many feet into the pillar at a short distance from the extreme end and then the coal in the "stump," or the section of the pillar between the pocket and the outer edge, is extracted. Again a pocket is driven, the stump is removed, and the process is repeated until the pillar is drawn. For other ingenious methods of drawing pillars see *Coal Age*, Nov. 8, 1923, pp. 695-8, and Pryde and Magraw, "Pillar Drawing in Thick Coal Seams," *Transactions of the American Institute of Mining and Metallurgical Engineers*, LXVI, pp. 415-21.

⁴⁵ But pillars may also be cut by machines. See Mitchell, A. M., "Underground Methods at Springdale Mines," *Coal Industry*, September, 1923, pp. 381-2.

⁴⁶ O'Toole, Edward, "Pocahontas Coal Fields and Operating Methods," *Coal Age*, March 18, 1923, pp. 399-407; Chalmers, James S., "Methods of Working Highly Inclined Coal Seams," *Coal Age*, April 12, 1923, pp. 589-93.

mining peculiarly adapted to them. A reading of the coal journals and of the proceedings of institutes attests the zeal with which engineers have attacked this problem. In one mine a block system marks an even greater departure from the conventional pattern than does the panel.⁴⁷ In another, long-wall advancing and retreating is combined in a single ingenious pattern.⁴⁸ Of special promise is the V-system, a clever fusing of the panel with retreating mining (see Figure on p. 130). The rectangles which make up the floor, are divided into long strips, each of which is mined along two diagonal faces, which together form a V. The coal is carried away by face conveyors which at the point of the V empty into larger ones. These, in turn, transport the coal along a narrow passage and at the entry dump it into cars. Since the length of the diagonal faces and the angle of the V are alike subject to variation, the method is a very flexible one.⁴⁹ Most important of all is the tendency in the newer schemes towards long-wall mining. If the influence of the machine

⁴⁷ Bissell, H. R., "Block System of Mining," *Coal Age*, Oct. 30, 1924, pp. 613-4.

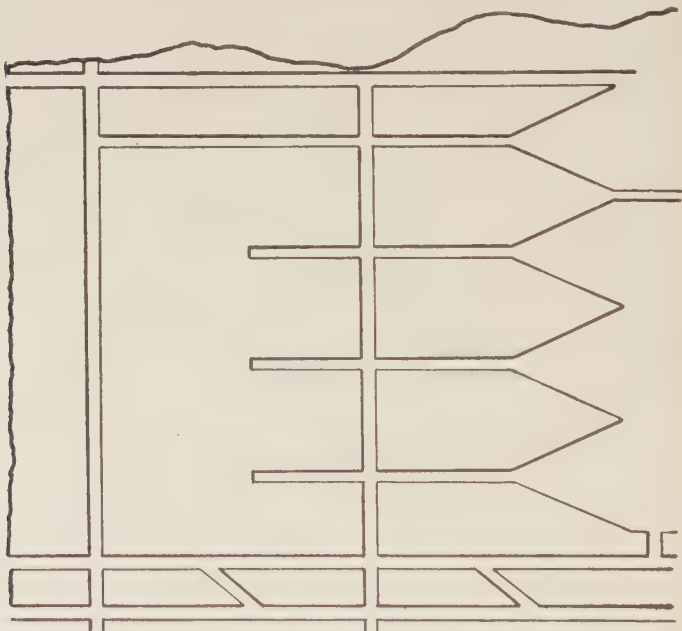
⁴⁸ For various ingenious patterns of mine development, see *Coal Industry*, March, 1923, pp. 155-62; October, 1923, pp. 418-20; October, 1923, pp. 424-6; December, 1922, pp. 515-20; *Coal Mine Management*, September, 1922, pp. 22-4. See also *Coal Age*, March 8, 1923, pp. 399-407; Nov. 27, 1924, pp. 745-50; March 19, 1925, pp. 425-30; March 12, 1925, pp. 394-8; April 2, 1925, pp. 402-7.

⁴⁹ Brosky, A. E., "With Hand Shoveling 10 Tons per Man and 26 Tons per Loader Already Attained," *Coal Age*, Feb. 7, 1924, pp. 197-203; see also *Coal Age*, June 26, 1924, p. 950; July 24, 1924, pp. 109-12; Nov. 20, 1924, pp. 711-4.

will not force it, "the needs of ventilation, supervision, and drainage will do so."⁵⁰

The use of machines and the planning of operations alike forbid leaving organization to chance.

SECTION OF MINE WORKED BY V-METHOD.



Where loaders are eating up costs, cutters and haulage must be on the job; where operations must march with a single step, the miner cannot be a law unto himself; where safety lies in being at a certain

⁵⁰ *Coal Age*, March 26, 1925, p. 457.

place at a certain time, the straggling worker must not be caught outside the lines. The number of under-cutting machines must be adjusted to the volume of coal to be moved; loaders must be of just a size and of the right number. The haulage system, stretching away from the face to the tippie, must, at every point, be equal to the demands upon it. It is not mere rhetoric to say that the mule is an obstacle that no loader can overcome.⁵¹ So it is with timbering, with pumping, with power production, with each of the score of processes which make up the machine-getting of coal. The coal mine in which every factotum lords it over his operation as he pleases must go. By supervision from above the elements of mining must be forced into an articulated process which remains a going concern. Unless this is done the costs in disorganization and waste will swallow up the promised gains.

All of this means work, and clever work, for the technician. Machines, for all their power over the industry, are not self-installing, and installed machines are not self-operating. Their very installation means an added cost, and it requires their effective use to offset this with a profit. In America, where mines are run on a single shift, and machines must earn keep for themselves and profits for their

⁵¹ For accounts of the importance to the whole mining process of an articulated haulage system see Stock, Fleming, and Hoskin, "A Study of Mine Haulage in Illinois," *University of Illinois Bulletin*, No. 49; U. S. Coal Commission, *Underground Management*, by Thompson, S. E., and Eavenson, H. N.; see also *Coal Mine Management*, November, 1922, pp. 15-26.

owners in eight hours, competent technicians are imperative. Even now most states require a minimum of competence of those who actually manage mines, a demand mild enough to be satisfied by a superficial examination or a diploma from a snow-bird technical school. Where coal-mining is a craft, such standards may suffice to give a crude sort of safety to the undertaking. But, when it becomes a mechanical process, real knowledge and a high degree of skill are demanded from managers and engineers. In the mine the technician faces a far more difficult task than in the factory. The factory demands an engineer capable of setting-up and operating a machine-system; the mine must have a technician competent to keep going a complex system which must forever be remade to meet new conditions. Difficult as it is in a new mine, the work of the engineer is doubly difficult in an old one whose rambling lines are a tribute to what the absence of foresight can effect. Here knowledge, patience, and cunning must wrestle with past mistakes in planning and in operation to gain even a gradual approximation to an economical plan.

In innumerable ways like these the elements of a new process of mining are emerging. A comparison of the advertising pages of the current issues of the trade journals with those of a few years, or even a few months back, will give evidence of the coming of new contrivances. A study of the changing character of the reading matter will testify to the grow-

ing attention of coal men to the developing art of mining. There is, so far as competent evidence can be had, no technical obstacle in the way of "the new mining." The cult of efficiency seems justified in its talk about "the big push."

V. THE FACTORY SYSTEM

A development in the art of mining, even more startling, seems imminent. The production of coal by machines is only a half-step towards the new technique; it is already threatened by a machine-process of extracting coal.

In the bituminous industry, as elsewhere, thought about the new moves in terms of the old. The English railway coach still gives evidence of its origin in a carriage. The early motor-cars, naturally enough, had buggy wheels and a place for the whip. It is inevitable that the pioneers in machine mining, seeing new possibilities through the darkened glass of the craft to which they were accustomed, should still make the miner at the face the focus of their plans. In a carry-over from craft mining they invented a machine to undercut the coal, contrived another to load it, replaced the mule with a locomotive, squared the layout with the new equipment, and assumed the task of keeping the made-over system going. The idea of a mechanized process of coal-mining, of a new technique for the whole operation, and a new division of labor came slowly.

But the evidence above is of a half-told story.

The description at almost every point runs off into tangles and problems and fresh demands. The alternate use of cutters and loaders at the face is wasteful; there is too much of a break between loading and haulage; the layout still has written through it the provision of places for craft-miners; a need for order amid the new complexity makes extravagant demands upon the management; the new elements cannot easily be spliced together into an operation which is like the old one.

Moreover, thus far there has been one serious oversight. The use of explosives to break the coal down is the heart of the difficulty in co-ordinating processes. After the machine has undercut the coal, the whole process of mining comes to a stop. Then follows a complicated ritual of removing the cutter, boring a hole, filling it with powder, tamping the shot, firing it, waiting for the room to clear, and entering with the loader. So long as these interruptions occur at the cutting edge of the mining process, the articulation of activities is called upon to meet irregular operation. The firing of the shot, therefore, is a source of disturbance which the most wonderful of contrivances and the most efficient of organizations cannot overcome. So long as the firing of the shot endures, the mining of coal cannot become a continuous process.

This interruption, therefore, has become the point of departure for a series of experiments. These have accepted nothing from past experience. After

months of continuous trial these efforts are resulting in a new art of mining which is as simple as it is radical. The greediness of the older methods, which at a single bite attempted to take away a huge block of coal, was its undoing. The miner, who had driven an incision of four feet into the face in an attempt to break down coal of an equal height, had to invoke explosives to help him through an unfinished task. The newest mining makes modest but insistent demands upon the unmined coal. A machine, equipped with two, three, or four cross-cut saws, set at distances of ten inches apart, drive incisions a foot into the face.⁵² As the machine advances, a scraper attached pushes the loose coal into a face-conveyor. This, linked with others of its kind, carries it away, down entries, along mains, and to the tippie. Since the getting of coal is carried on along a long wall, one machine may follow close abut another. Thus, when the hampering vestiges of obsolete ideas are removed, machine-mining gets a fair chance. It links every operation, from face to tippie, into a single continuous process. The problem of order, with a single technical activity as its concern, becomes simple.

As yet only a stray item or two from the experi-

⁵² These dimensions and quantities are, for obvious reasons, incorrectly stated. In fact, while the technicians in charge know about what the quantities must be to get best results, further experiments may change them slightly. Moreover, they must vary to fit the conditions peculiar to the mine. The "general principle of the thing" is accurately set down in the text. For the argument that is enough.

mental mines have reached the prints.⁵³ The company is not yet ready to announce its new methods. Many problems must be cleared up before the newest mining is ready for amateurs to use. But the technicians insist that the dominant features of a new technique have been worked out, that the larger difficulties have been overcome, and that only details remain to vex their ingenuity.

It is a far cry from a mine composed of separate working places for individuals to one which is, as an old craftsman put it, "nothing but a damned factory, and a Ford factory at that."⁵⁴ The newest, or even the newer, mining may well be halted by the many obstacles that lie between sound technique and its introduction. But if the other tests which it has to meet are passed as successfully as the demands of engineering, the lingering individualism of the coal mine will soon be gone forever.

⁵³ Other experiments, with the same objective, are going forward. Recently there has been announced the "O'Toole machine," which represents a more orthodox way of getting at the same problem. This machine is composed of "an electric motor and gear box," "a segmented cutter-bar that undermines the coal face," "a segmented conveyor that receives the coal," "a propelling mechanism," and "hydraulic jacks that control the roof pressure." Since the cutter chain and the "scraping type" of conveyor form a single piece, the use of explosives is eliminated and there is no interruption between cutting and loading. See Kneeland, Fred H., "O'Toole Machine Is a Combined Cutter and Loader," *Coal Age*, May 28, 1925, pp. 783-7.

⁵⁴ Goodrich, Carter, *The Miner's Freedom*.

CHAPTER VII

THE LURE OF LOWER COSTS.

He wished all men as rich as he
(And he was rich as rich could be,)
So to the top of every tree
Promoted everybody.

—*The Gondoliers.*

I. THE STRATEGIC PLACE OF MANAGEMENT

In the world of here and now technical possibilities do not always become current realities. The modern mining can neither invite itself into the bituminous coal industry nor determine the speed with which it will replace an honorable and wasteful craft. The rate of its coming and its incidence upon all coal mining must wait upon the judgments of the managers of coal properties. As industry is currently organized, the decision of "the operator" to adopt or to exclude innovations has a double significance.

On the one hand, it affects the ability of the individual enterprise to survive. The management of each concern, in terms of profits and costs, must weigh the competing claims of the old and the new mining. If novelties are to be welcomed, it must

decide the order in which old practices go, the opportune moment for the introduction of each new device, and the rapidity with which the modern methods come to dominate the mine. These judgments must be shrewdly made; for it must sell its coal in competition with others and the market may be seriously affected by the fact of technical change in other establishments. The decision of the operator is, in short, an aspect of an endless business policy which seeks solvency by careful adaptation to a rapidly changing situation.

On the other hand, in the generality of such individual judgments lies all the formal control which those in the industry have over its development. There is nowhere, within the industry or even without, a collective authority to give the new technique the run of the mines or to refuse it admission. There is no power to say at what rate it shall be introduced, to impose conditions upon its coming, or to take thought against any evil consequences. Such general control as there is, in bits large and small, is democratically distributed, as rightful perquisites, among the managers of 7,000 separate coal properties. The coming of the new mining, its conquest of the industry, and the things which will follow in its wake are all the accidents of the medley of countless individual judgments. The industry waits upon the individual; the future must obey the moment; the big decisions must be the by-products of little ones.

At the point of choice the decision of the management is alike a response to and a cause of the stream of passing events. It is, therefore, the beginning of the story of "the industrial revolution" in coal mining.

II. THE PROMISE OF MINE ECONOMY

To modernize or not to modernize? That question is today engaging the attention of every alert manager of a coal property. Since the inquiry belongs to the calculus of profit-making, the answer must run in terms of the expenses of production. It is, therefore, necessary to translate the promise of the new technique into the language of accountancy.

For the purpose it is well to distinguish between the activities involved in winning coal and those concerned with bringing men and materials in, keeping operations going, and getting the coal out. The primary question of economy is to make the mining of coal at the face as wasteless as possible. The secondary question is to keep the enveloping organization going as regularly and economically as may be.

The impact of the new mining is to be felt first at the face. Here the promise, from machinery and from planning, is to economize the labor and materials used in mining. Machinery allows miners to use in their work devices which greatly increase the return from a given expenditure of energy. Planning permits an escape from the waste and idleness

which attend irregular operation. Together they promise startling savings in the use of labor.

In the organization of the enveloping activities the new mining offers three distinct advantages. First, the introduction of mechanical devices throws upon the power resources a burden now borne by human beings. Second, the careful articulation of these processes to each other and to the operations at the face, promises, out of current waste, great savings in human and material resources. Third, and most important, the increased rate at which the new mining advances the face offers substantial economies. Its very speed permits more coal to be taken from the same area and concentrates operation. This simplifies the problems of planning, of supervision, of haulage, of ventilation, and of pumping. Since many of these operations have to be carried on continuously while the mine is running, and do not vary greatly with the amount of coal extracted, the saving is almost proportional to the increased rate at which the face is advanced. It goes without saying that if mining by machines can grant these economies, even greater ones are promised by a real machine-process of mining.

All of this, in the sheets of the cost accountant, is clearly to the credit of the new mining. The cost of the man with the cutter is less per ton than that of the pick-miner. The cost of machine-loading is far less than that of loading by hand. The haulage crew, with real locomotives, can spread its cost over

many times the tonnage of the gang which uses mules and has never heard of a schedule. The more closely knit organization will squeeze a little reduction in "overhead" out of hoisting, pumping, ventilation, and many other operations. Systematic planning will prevent wasteful development from imposing a permanent capital charge against the establishment. Moreover, every increase in the speed with which the face is advanced both reduces the direct cost of extracting coal and spreads the fixed charges over an increased tonnage. The only off-sets to these savings are the interest upon the investment in the new equipment, the costs of their maintenance, and the expense of the increased supervision. If the mine lends itself to the new mining, and the new system can be kept going, these are small in comparison with the resulting gains.

So great is the promise of lower costs that mining by machines may pay handsomely even though the costs which attend its introduction seem unreasonably high. For example, it is argued that an undercutting machine will pay if the costs of its maintenance plus the wages of its operators do not exceed the wages paid the replaced pick-miner. Yet the machines might yield a surplus if the men who run it are paid as much per ton as the hand-miner gets for the same work. For the increased rate at which the face is advanced reduces the unit cost of superintendence, of maintenance, of pumping and the like.

A manufacturer of equipment insists that mining concerns who are his customers have found loaders such labor-replacing devices that they have saved on housing enough to pay for the machines.¹ So, too, with skillful use locomotives, hoists, pumps, boilers, and dynamos, may in increased tonnage be made to pay, even though their operators receive wages which according to old notions seem extravagant. In fact all along the front where coal is won from nature, kilowatts of mechanical energy, for all their initial expense, are far cheaper than pounds of flesh and blood and the wastes of inefficiency.

So it is, too, with the costs of an efficient personnel in high places. An engineer, in a mine of 50,000 tons capacity, has to wring from waste but ten cents a ton to create for himself a salary of \$5,000 a year. In a mine of 200,000 tons a similar saving will aggregate \$20,000 annually. Any sizeable mine offers to a technician a chance to earn his living and something more for stockholders or consumers to quarrel over. Even smaller mines need not content themselves with self-certified engineers, or none at all. A number of them can combine, as a number of them are doing, with as little violence to the Sherman Law as a circuit of village churches, to keep an itinerant technician on the jump. In short, technicians whose services are essential to real organization and low unit costs ought to be able to wring from waste more

¹ Fourth Standardization *Bulletin* of the American Mining Congress, 1924, p. 35.

than enough to pay for their own services. They are an economy which no efficient mine can do without.

But accountancy is an instrument, not a magician. It cannot promise such gains unless conditions underground permit the machine-process to be used. There are two possible obstacles to its practical use and to lower unit expenses of production. The one is the geological conditions to be met, the other an addition to the risks of the miner's trade.

The geological conditions which obtain underground present no serious obstacle. If, like so many peoples of Europe, we had to take our supplies from thin seams which nature had by twists and faults thrown into confusion, the machine-process might halt long before the rebellious workings were subdued. But it is our luck that our deposits are prodigal and of comfortable thickness; that seams run as they ought to run. In some mines very crude machine methods are effective. In others flexible new processes and skillful engineers can easily overcome difficulties in geological structure.² The truth is with the salesman who said to a hesitating customer, "Maybe loaders won't work in your mines; but the mines that can use them can turn out a damn sight more coal than can ever be sold."

Nor will the difficulty of making machines safe impose more than a passing barrier. At the worst,

² Campbell, Marius R., "The Coals of the United States," in Bacon and Hamor, *American Fuels*, Vol. I, pp. 1-43.

the addition of a casual hazard or two will not seriously disturb persons who are generally indifferent to the current absence of safety in the industry. At best, if we are to bother ourselves about a real safety code, there is likely to be only a temporary case against the new mining. Aside from dangers which attend the operation of machines everywhere, the added risks come largely from the underground use of electricity. In gaseous mines there is always a chance that a spark will cause an explosion. In fact the use of electricity was long considered as dangerous as that of gasoline.³ But recently the Bureau of Mines has put the stamp of official approval upon certain "permissible machines." The first approved coal-cutting equipment was installed in 1915 and the first storage-battery locomotive in 1921.⁴ Although their use is, so far as federal authority goes, wholly voluntary, the number of installations is steadily increasing.⁵ The casual evidence of recent explosions seems to indicate that the real source of accidents lies in non-permissible equipment. If a deliberate effort is made to render the machines increasingly safe, and if only danger-proof ones are allowed to be used, the extra hazards should quickly dis-

³ Even today English technicians are "touchy" about the use of electricity in gaseous mines. In such mines English law still prohibits haulage by locomotives with overhead wires.

⁴ Ilsley, L. C., "Safeguarding Mine Equipment," *Coal Industry*, June, 1923, pp. 91-4.

⁵ For a list of these machines, somewhat out of date, consult the circular by Ilsley, L. C., entitled *Regulations Safeguarding Coal-Cutting Machines*, issued by the U. S. Bureau of Mines, December, 1922.

appear. Moreover, the newer methods, by encouraging better organization, by insuring more careful supervision, and by decreasing the number of men employed, promises to promote safety.

In economy, in adaptability, and in safety the promise of modernized mining seems to be unconditional.

III. THE MANAGER'S PROBLEM

It chanches, however, that the new art of mining disturbs the cost-sheets just enough to turn a direct promise into a vexing problem. Under the old system the men who mine coal and load it are paid by the ton; the company men are paid when the mine is running, and machines not installed and technicians not employed get no pay at all. The items of cost are for the most part direct expenses, varying approximately with the tonnage. Under the new system the initial cost of equipment is incurred once; an increased percentage of mine workers is paid on a time basis; the salaries of engineers have to be paid whether much coal is being extracted or little. The items of cost increasingly become overhead expenses which click on with the clock. Accordingly the issue which the rival arts of mining present to the operator is one between high unit costs, which may let up somewhat when there is no demand for his coal, and low unit costs, which show little mercy even in dull seasons.

The problem is not an easy one. Each operator must make his decision with one eye on costs and

the other upon the probable demand for his coal. It takes only a single judgment to install a machine; it requires a continuous demand for coal to make it pay. Therefore, the manager must shrewdly anticipate a market which months or even years later may wreck his calculations. Moreover, as current technology stands, a single wise and courageous decision is not enough. The machine-process of mining does not belong to the present; for some time to come the new art is to be adopted piece-meal. Each new device will change somewhat the proportion between direct and overhead expenses; each new installation will add its bit to the need for a steady market. Accordingly, by a long series of judgments the operator must choose his time shrewdly, direct carefully the order of innovations, and even by deliberate action make circumstance help him through his crisis.

The maintenance of such a policy makes heavy demands upon even the most efficient management. If coal were as we hear that other industries are, the efficient manager ought not to have to worry about regular operation. Wasteless methods mean lower prices, and lower prices are an open sesame to markets. Since the mine which uses the best methods of the eighteenth century cannot dispose of its output so long as the low-cost mine has coal to sell, the efficient venture should be assured of a continuous demand.

It happens, however, that some rather human ar-

rangements stand between the cost of coal and its market. Its production must be correlated with the use of coal and with its transport. Here the seasonal consumption of coal, the structure of railroad rates, and the prevailing scheme of car distribution, alien as they are to true mining, are barriers in the way of sustained operation. Each is enough of a plague to the management to deserve its paragraph.

The first obstacle is the irregular use of coal. Most obvious is a variation with the ups and downs of industrial production; the demand for coal reflects the business cycle. Second, the few direct figures upon consumption and the indirect evidence of statistics of production and transportation indicate a seasonal purchase.⁶ The railroads, manufacturing establishments, and domestic consumer require more coal in cold weather than in hot. Electric and gas plants require more fuel when days are short than when they are long. Office-buildings use little coal in summer and much in winter. In off-season these requirements range from 20 to 90 per cent of demand at the peak. And, third, mining operations are affected by the caprice of demand from month to month, or even from week to week. So long as "customers remain whimsical and unchangeable," and "the multitude buys on the spur of today's necessity,"⁷ the operator is not assured a regular demand.

⁶ Tryon, F. G., and Hale, Sydney A., "Coal in 1919, 1920, and 1921," *Mineral Resources of the United States*, U. S. Geological Survey, Vol. II, pp. 462-72.

⁷ The Mining Congress *Journal*, March, 1925, p. 98.

The exceptional concern may, by diligence and salesmanship, keep its demand constant throughout the year. But, if it does, it imposes upon other concerns an increased burden of irregularity. Accordingly the ordinary mine, and the average of the trade, must be content with an irregular market.

A way out is to mediate between the irregularity of use and the regularity demanded by production. This can be effected through storage. The consensus of competent opinion is that the technical difficulties, once thought to be insurmountable, have largely been overcome.⁸ It is now agreed that tons enough can be stored, without serious deterioration, to allow production to proceed regularly. Seasonal prices have been and may be offered to increase spring and summer purchases of bituminous. Railroad rates, too, have been and can be manipulated to make it profitable to consumers to purchase coal out of season. In such cases the discount is to be set down by the coal company against the returns of more regular operation or by the railroads against a more economical use of equipment. But, if the user of coal refuses the bait, the operator may, at an expense which imposes less of a tax than irregular operation, fill part of his winter orders out of stock.⁹

⁸ American Engineering Council, *Industrial Coal—Purchase, Delivery and Storage*, 1924.

⁹ At present 40,000,000 tons of bituminous coal are usually in storage in the early autumn. An increase in this amount by only 50 per cent, or a total of 61,000,000 tons, a figure which has been exceeded three times in recent years, is all that is needed to solve the problem for the industry. At present, however, coal is held in

Thus the ability to utilize storage becomes a factor in his program for the introduction of the new technique.

A second obstacle is the structure of freight-rates. The ability of a mining concern to survive depends, not upon the price which coal brings, but upon what is left after the railroad has exacted its toll for transport. Since freight charges are embodied in a structure of rates which has responded to all the accidents of development, they may give markets or deny them. There is now a complaint before the Interstate Commerce Commission that differentials to the West Virginia fields, once fair enough, have, through the caprice of repeated revisions, become quite unfair to the Pennsylvania operators. The different rates of growth in different areas, which result in changes in the demand for coal, or widening and narrowing differentials in freight rates, may rob an efficient operator of his market and give it to an inefficient one.¹⁰ The management which by diligent

reserve largely by its users, rather than by its producers. Tryon, F. G., and McKenney, W. F., *Off-Season Purchase of Railway Fuel*, U. S. Geological Survey.

¹⁰ The rulings of the Interstate Commerce Commission may very well increase hazards for the efficient mine management. It has announced a policy of disregarding mine costs in fixing the rates on coal and of preserving strict neutrality between regions and shipping points competing for markets. If this is done the mine which uses machinery will at least be free to extend its markets and keep its gains. But the Commission has actually made a decision the effect of which is to allow lower freight rates to compensate mines for increases in costs. Despite the fact that lower rates permitted competition by inefficient mines, this was not the stated purpose of the Commission in lowering the rate. South-western Interstate Coal Operators' Association *vs.* Arkansas West-

search must find an added demand to make the new mining pay and the one which must hold even its most distant customers to keep steadily going must make a place for the vagaries of rates in their formulas for avoiding insolvency.

A third, and even more serious obstacle, is the current system of car distribution. It chances that cars, of which at certain times there are not enough to go round, are within the control of a public authority. At present the Interstate Commerce Commission in times of shortage allows the available cars upon each railroad to be distributed to mines along its lines in terms of their respective capacities.²² This division in terms of potential output frequently results in the allocation of cars to high-cost mines when they could be filled with coal at a lower cost. More serious still is a provision which virtually gives priority to mines which are in an initial stage of development, thus baiting unwanted adventurers into coal mining. These practices increase costs by adding to the number of mines, by enlarging the face-area from which a given tonnage is to be taken, and by causing coal to be taken from high-cost mines that could have been had from the sur-

ern Railway Company, 89 I. C. C. Report 73, Docket No. 14,661. See also *San Toy Coal Company vs. A. C. and Y. Railway Company*, 34 I. C. C. 34 (1915.)

²² There has been no general ruling to this effect by the Interstate Commerce Commission. The current practice has been worked out by agreements between the railroads and the various coal associations or the operators in the territory served. The rules, of course, have been approved by the Commission. See files of the I. C. C.

plus capacity of efficient ones. Through favoritism to backward practice it imposes a great burden of waste upon the consumers. More directly it arrests the introduction of machines by taking from the efficient mine the last increments of demand which are essential to regular operation. This arbitrary scheme, which disburses carriage, so essential to efficient methods and lower costs, without regard to markets, costs, or prices, actually takes custom from those who can produce cheaply to give it to those who cannot.

It seems a fair presumption of the prevailing economic order that when there are not enough cars to go round, they should go to those who have markets for coal.¹² Yet recently the Interstate Commerce Commission rejected a proposal, sponsored by the late Coal Commission, to take "commercial demand" into account in allotting cars. Strangely enough they argued that the Commission, which is merely an administrative body, must preserve the utmost impartiality between parties to a competitive struggle.¹³

¹² Of late there has been no report of a car shortage. Such a shortage, however, is certain to come when the work of the mines is resumed after a protracted strike or other interruption. So long as the threat of an interrupted flow continues, the matter of car supply must be of importance.

¹³ See Interstate Commerce Commission, *In re Rules Governing Ratings of Coal Mines Other than Anthracite, and Distribution of Cars to such Mines*, No. 13,896, Dec. 23, 1921. An examination of this opinion reveals the peculiar assumptions upon which it is based. The conventional argument for competition assumes as its end the elimination of the inefficient and as its means the test of the market uninfluenced by special favors to any party. This

So long as there is no immediate prospect of a revision of the rules of car distribution, the individual operator must meet this hazard as best he can. The railroads may ease this situation by handling cars with a bit more dispatch. The very increase in capacity which modernization brings, despite the arbitrary ways by which it is measured, should give to the efficient mine more cars. Further relief can be found, as relief has been, by inducing purchasers to buy in off-season, "when the cars are running." Most important is the possibility of more equipment. Since the unit in the pool is not all cars, but only those upon a single railroad, a group of progressive mines may persuade the carrier who serves them that it will be profitable to purchase more cars.

Such are the complicating factors of use and of transport which must constantly be taken into account by the management bent upon modernization. Of these irregular demand is of least account; for storage can mediate between irregular use and a regular program of production. The structure of railroad rates is more serious; for, quite apart from horizontal increases or decreases in schedules, a search for new increments of demand runs into the unknown effects of a structure designed for other purposes. In addition a tendency of the Interstate Commerce Commission through day by day decision for competition refuses to accept the market as a sufficient test, and under the pretense of preserving "a fair field and no favors," preserves a system which discriminates in favor of the inefficient. Commissioners Potter, Eastman, and Cox dissented.

sions to preserve an "equality" in "competitive" condition, which efficiency tends to destroy, may well increase the handicap. The system of car distribution is thoroughly uneconomic; it may well cause the best calculations of the enterprising manager seriously to go astray. Together those obstacles, added to the technical difficulties of accommodating the machine-process to the art of mining, make the problem of modernization for the ordinary manager a protracted one beset with many hazards. In the period ahead he has his work cut out.

IV. THE DIFFICULTIES OF JUDGMENT

Nor is the ordinary management of the usual coal company in a position to make the shrewd judgments which survival demands. In the face of the uncertainties which must attend the transition, two conditions make it extremely difficult for those in power to turn the changing situation to account. One is the inadequacy of accounts to guide in the formulation of policies. The other is a general ignorance about the current state of the industry and the unknown future into which it is rushing.

The lack of the knowledge of its own internal affairs has made the ordinary management of a coal property notorious.¹⁴ The status of its accounts makes it well-nigh impossible for those in authority

¹⁴ See the discussion of the records kept in the coal industry, in the chapter entitled "The Compromised Control," p. 46.

safely to cut a way ahead by a series of wise decisions.¹⁵ The recognized function of accountancy is beyond dispute. Pecuniary expenses accurately represent the real costs of production: records are but an expression in quantitative terms of an economic situation; and a balance-sheet is a summary of the factors which find expression in business judgments. The lower prices of the efficient concern, due to lower costs, in turn due to wasteless methods and articulate organization, will alike insure it wide markets and an ample margin of profit. Under the guidance of sound accountancy, it can fearlessly engage in competition with more wasteful concerns, and, by a series of shrewd business judgments, weather a confusing and dangerous crisis.

The ordinary set of accounts is, on the contrary, neither a rod nor a staff for the period ahead. A model scheme for the keeping of accounts has been worked out and recommended to the trade.¹⁶ Its use has been quite limited. Graphic charts have been exhibited, greatly admired,¹⁷ and little employed. Some of the larger concerns keep records which are comparable in accuracy and relevance with those in use in the better establishments of other

¹⁵ See evidence in Cost Reports on Coal of the Federal Trade Commission, and the reports of the U. S. Coal Commission, *The Cost of Production of Bituminous Coal, and Investments and Profits in the Bituminous Industry*.

¹⁶ Publication of Production and Profits in Coal, hearing before the Committee on Manufacturing, U. S. Senate, 66th Congress, 3rd Session, on S.4828, Vol. 1, pp. 181-203.

¹⁷ *Mining Congress Journal*, March, 1925, p. 105.

industries. But in general, accountancy does not thrive in the blacklands.

If records alone were to be believed, there is circumstantial evidence that many managers cannot figure. There is an abundance of evidence that even bookkeeping is a mystery little understood and clumsily practiced by them. The story goes that all coal companies keep books, since it is understood in the trade that anything is a book that is a "memo." One concern prides itself upon its "loose-leaf" system of bookkeeping, even though the leaves are so loose that they are merely slips of paper pitched into a drawer.¹⁸ But enough, perhaps more than enough, of specific instances.

To confound the matter there is little agreement about what is a cost. One concern forgets all about investment and accounts itself solvent if it can make a little more than operating expenses. Another loads itself with a charge against inflated capitalization that is forever a source of financial difficulties. One corporation charges against coal produced the expenses of maintaining large reserves; another has no reserves to justify such an entry. It is a wise cost that is sure of its own column. During the war, when prices were made in Washington, and operators were concerned lest they be fixed too low, there was a tendency to charge doubtful items, and some not

¹⁸ These instances, and others like them, were given to the authors in conversation by persons who for years have had a first-hand acquaintance with accounts in the bituminous coal industry.

so doubtful, to operating expenses. At its close, when the real pressure became the payment of the corporation tax, and operators were solicitous lest the rate of return be too high, all of these, and more too, were won back by the capital account.¹⁹

The capital charge is further confused by the form of business organization. The individual, or perchance even the partnership, can get along with little bookkeeping and remain solvent even if there is no profit upon the investment. The corporation whose outstanding securities consist exclusively of shares of stock can run for an indefinite period without profits. The company which mortgages its earning capacity with bonded indebtedness must pay a return upon its books or "go broke."

Similar statements may be made about the other accounts. One concern is indifferent to wear and tear, another writes off depreciation recklessly. One charges highly for the "depletion" of the coal in the ground, another is ignorant of the word. There is at least a gambler's chance of finding in the books of some coal company or other most of the correct and all of the incorrect ways of charging up an item of expense.

A series of decisions based upon varied, incorrect, or non-existing figures is likely to be as meaningless

¹⁹ Occasionally the art of accountancy becomes very purposive. Recently an inquisitive soul chanced upon a concern which was emulating the great Columbus by keeping two sets of books. One was quite useful when the issue turned upon evaluation, the other was more nicely adapted to tax assessment.

as the accounts themselves. Many instances can be cited of the unguided and unexpected results which follow from coal-mining accountancy. A mine in Pennsylvania, because of an extravagant bond issue, was unable to turn out coal at a low cost and lost its customers to a competitor. Bankruptcy and reorganization wiped out a large part of the capital charge. Thereupon, the reorganized corporation, by the low prices which it quoted, not only won back its customers, but also took away those of its competitor, forcing it in turn into the bankruptcy court.²⁰ It is hardly to be hoped that the guidance offered by such accidental things as pass for costs will give the knowledge demanded by the difficult judgments ahead.

Likewise the decisions of the manager must take account of the current state and future prospects of the industry. A knowledge of the larger situation, as well as of its own particular affairs, is necessary to a policy which will take the individual concern safely along the way of solvency. The management must install its new equipment and perfect its new organization at a time when it is promised a return upon its investment. It must limit its capacity, as fixed by the new technique, to the coal it is reasonably sure to sell, and make this the unit in its operations. It must expand production when there is a market

²⁰ Reported by a governmental official whose duties keep him almost constantly in the bituminous fields. Another instance, quite typical, is reported in *Cushing's Survey*, Feb. 12, 1925.

to be won and a good price to be had. It must avoid rushing with unwanted coal into a market already glutted. It must, in addition to its proficiency at coal-getting, be able to make a guess at least as good as the forecaster's about the situation ahead. It must hold a wise policy flexible enough to meet changing conditions.

For three reasons the ordinary management will find it difficult to base its decisions upon an adequate knowledge of the general situation. The first is that the situation cannot easily be reduced to terms which will pass as knowledge. The industry into which new methods are coming is far from an orderly one. Those who manage coal mines usually think and act in isolation; the doings of other managements are to be discovered, not as intent, when they can be taken into account, but as a result, when it is too late. There is no composite picture of even the current situation which is an authentic likeness.

The second reason is that the average manager is likely to miss even such knowledge as is available. Those who run most coal properties see rather dimly what is happening in the industry. They are prone to do their day's work in the appointed way, mine coal when a market is in sight, add equipment and make changes in organization when the necessity cannot be denied, and let each day take care of itself. Neither by training nor by everyday experience are they in the habit of considering the places of their own establishments in the bituminous world as a

whole, or of relating their individual problems to the larger situation.

The third reason is that the rank and file of operators cannot obtain guidance from within the industry in this problem of long time accommodation. The many associations which serve them are organized to fight hostile legislation, to resist the exorbitant demands of mine-workers, to win the good-will of politicians and public, and to serve other immediate and acquisitive purposes. They are not prepared to furnish the members with detailed analytical statements of the trend of affairs in the history.²¹ The trade journals, excellent as they are upon technical matters, take little account of the place of the industry in the economic order, of the influences from far and near which disturb it, and of the problems which these bring. The view-point, naturally enough, is one which, like the mottoes in the copy-books, makes the success or failure of the individual operator a matter of how well he runs his own establishment, as if the industry to which he belongs and the great world beyond it must remain the same. In the pages of the trade papers one reads of the glowing promises of the new technique in eliminating wastes and reducing costs. One finds there few words about the effect of all these things upon a

²¹ See the "constitutions" and other literature issued by National Coal Association, New River Coal Operators' Association, Indiana Bituminous Coal Operators' Association, Illinois Coal Operators' Association, Kahawha Coal Operators' Association, Southwestern Interstate Coal Operators' Association, and others.

general situation which the judgments of every operator should take into account. Since the manager does not have access even to such knowledge as is available, he thinks in terms of a static situation which has no existence.

A wise course of action is a compound of many wise decisions. Neither the records of the individual mine nor the chronicles of the industry are adequate to the purpose. Nor has the individual manager either the inclination or the resources to gather this larger information for himself. Accordingly he must make his adjustment in ignorance of the things to be adjusted.

V. THE WILL OF THE MAJORITY

What, then, will the generality of operators do? What of "the great coming" of which the technicians speak? Will the new art of mining become universal, strike a truce with craft methods when the industry is half-conquered, or find forbidding barriers at its very boundaries? In the battle of the cost-sheets is victory to go to the method which offers high cost with relief in time of stress or to the one which promises low costs which must be regularly met?

The answer depends upon the willingness of operators to give to the factory system a foothold within their establishments and upon their patience in waiting for its adaptation to varied conditions underground. But the power of managers is not absolute. The initiative really rests with the technicians.

They must recommend innovations, and, by argument and experiment, persuade those who have greater authority to adopt them. A veto-power, always nominal and often real, lies with the mine-workers. Machines cannot be used unless men can be found to work with them; they cannot be profitably employed unless the terms of the wage-bargain permit it. But the final decision to begin, to continue, to make effective mechanization lies with managers and operators. The arguments of technicians and the attitudes of laborers are matters pertinent to judgments; but the actual decisions are to be made by executives.

The willingness of technicians to recommend departures from ancient practice depends in general upon their competence. Most engineers worthy of the name are zealous in the cause of the newer technology. Besides, they have too much of a vested interest in a change which increases their importance to oppose its coming. The hand-to-mouth amateurs who muddle technical problems are in general indifferent to the issue. The opinions of acting engineers, who are owners as well as managers of coal properties, range from lack of concern to open hostility. In an industry, understaffed with technicians, the urge forward has not enough competent support to overcome the weight of stagnant opinion upon mining practice.

The attitude of the mine-workers, who may have it in their power to veto technical advance, is indif-

ferent. They are reconciled to the cutting-machine and suspicious of the loader. On the whole they appear rather oblivious to the whole movement. There seems nothing to foresee, nothing to worry over, nothing to think about. There is little concern with changes which impend in the character of the tasks to be done or in the status of the working force. At the most, the mine-workers can impede or attach conditions to its coming in the union fields. At the least, they are human instruments of production whose wills have little to do with the change.

Upon this matter the run of opinion among operators exhibits the same variety which everywhere characterizes it. Many owners and managers have an instinct which tells them that machines will not work. Others are too established in their ways of thought to know that there is such a question as machine-mining. More daring ones, who have here and there tried out a machine underground, know that "experimenting" is "finding out those things which cannot be done."²² Some are quite willing to let the other fellow prove the case. If the new technique is to be accepted, it must not only be good; it must seem good to the operators. Against the cake of custom it is useless to appeal to enlightened self-interest; for the annals of coal make it evident that in the industry reason is not judgment. If every squire in the blacklands were moved solely by the

²² Third Standardization *Bulletin* of the American Mining Congress, 1923, p. 36.

self-interest of reduced expenses the industrial revolution in coal would long ago have become an episode in history. As it is, a few, but an increasing few, see the promised land of quantity production and wish to go forward and conquer it.

If the bituminous industry were organized under the control of politics, and the matter could be settled by a referendum, there is no doubt of the issue. If, properly enough, each operator voted, and each had only one vote, a tremendous majority would be recorded against modernization. If, more properly, each operator had votes in proportion to the mine capacity controlled, there would still be a substantial majority in the negative. If, for the purpose, the technicians and mine-workers were enfranchised, whether all coal men balloted together, or each of the three estates were polled separately, the vote would show a landslide against the new. Popular suffrage, however exercised, would quickly make an end of strange machines and strange practices.

VI. THE POWER OF THE RADICAL BLOC

But democracy is to enjoy no such triumph; for the bituminous coal industry is organized under the direction, not of politics, but of business. In business, things of this kind are not settled by the counting of noses; radicals are given powers which in government would not be tolerated; and the minority may make its will effective even against the opposition of the great majority.

As matters actually go, a small group, who refuse to accept ways of mining coal whose wisdom has been proved by age, may adopt wasteless methods and an improved organization without anyone's consent. If they can reduce costs and lower prices, these radicals may persist in their novel practices. If their calculations are correct, and the market proves their wisdom, they may, despite their revolutionary teachings in technique even exact of the majority an acceptance of radical practices as a condition of staying in the industry. For business, if it has the decision, discriminates in favor of the more as against the less radical; with the single proviso that they can give evidence of cheaper costs.

It is not difficult to discover the strategic group in the coal industry. If all technicians, all mine-workers, all baronets in the coal lands were equally wise or equally stupid, the new day might come up like thunder into a very confused industry, or it might be stayed indefinitely. But some of them have more acumen than others of them. For the final event it does not matter very much what the great bulk of them do and think.

The radical bloc, sure to be of appreciable size, can embark upon the new venture. The shrewd judgments of some may be balked by interferences with the business control of the industry, or by obstacles which come between low costs and a market for coal. The course of efficient concerns may be stayed for a time, as weapons of human interference,

such as the distribution of cars and railroad rates, are wielded to help the less efficient conservatives. Many, despite diligence and vision, may fall into bankruptcy. But some are sure to come through. The prizes, however uncertain, must seem alluring to men trained to see in efficiency and lower costs prospects of larger returns.

However irregular the process and however often it is arrested, it must go forward. The ranks of the radicals must be swelled; for sooner or later others must adopt the new methods or number themselves among those who once produced coal.

CHAPTER VIII

THE PERILS OF QUANTITY PRODUCTION

"That matter settled I shall reach
The 'Sixthly' in my solemn tether,
And show that what is true of each,
Is also true of all, together."

—*The Bab Ballads.*

I. THE MENACE OF POTENTIAL COAL

The new mining affects the industry as well as the operator. In the very promise of economy which the cost-sheets show lies a menace to all who are engaged in coal mining. For efficiency and lower costs mean more rapid operation; more rapid operation means an increased capacity to produce coal; and capacity to produce is, most briefly, potential coal. There are three sources of this increase in impending output.

The first is the advantage which machine-mining offers to the new mine. An abundance of resources has always made it easy for the novice to enter the industry. An obsession that coal is wealth tempts men of means, with or without knowledge of mining, to essay the perils of coal production. In the past virgin mines have been opened faster than old ones have been abandoned. In recent years new mines, using improved methods from the very beginning,

free from the necessity of compromises with an old system and unhampered by the dead hand of past mistakes, have been able to mine coal cheaper than established ventures. At present recent innovations give even greater advantages to the fresh venture. If the new technique has the steady development which seems in prospect, new concerns, with the latest devices and processes, may enter the industry with potential coal available at lower and lower costs. In the immediate future this invasion may be repeated time and again.

The second is the economy in working area which the new methods effect wherever introduced. The new processes, with swifter work and fewer interruptions, enable the face to be advanced more rapidly. If the rate of advance can be increased one-half, a company may take its tonnage from two-thirds of the area. If it can be doubled, half the area will suffice. In the one case a mine may, without any increase in face-area, increase its output by 50 per cent; in the other, by 100. The higher the rate of advance, the greater the addition to the capacity of the mine to produce.

The meaning of such "economy" to the industry is no veiled mystery. At present¹ the capacity of the industry to produce is above 1,000,000,000 tons; the average annual production of the last five years

¹ The latest available figure for "capacity" is 971,000,000 tons, for 1923. The 1924 figures are not yet available. See Appendix A, table on p. 264.

is less than half of this amount. If more modern mining methods are applied to one-quarter of the total working area, and if the rate at which the face is advanced is increased by only 50 per cent, the total capacity will be increased to 1,125,000,000 tons, or 625,000,000 tons in excess of present consumption. If one-half of the area is to feel the quickening touch of a technique which advances the face at an increased rate of 75 per cent, the total capacity will be swelled to 1,375,000,000 tons, a surplus over present requirements of 875,000,000 tons. If, in due season, the machine-process should make a factory-system out of mining the extraction of coal by a single uninterrupted operation ought easily to speed the face forward at three times its current rate. If this new method were applied to three-fourths of the mining area the total capacity of the industry would be increased to 2,500,000,000 tons, which is five times the amount of coal which annually is converted into fuel and power.

These figures, although they relate to potential coal rather than to output, are significant. The threat of an increase in the amount of potential coal gains force with the increase in the number of converts to "the creed of efficiency." The estimates of excess capacities of 625,000,000 and 875,000,000 tons may possibly be surpassed in the immediate future.² The excess of 2,000,000,000 is not likely

² When this calculation was first made the latest available figures were for 1921. It is significant that in the first two estimates

to become real; for, even in bituminous coal there should somewhere come a point where excess capacity will halt, at least for the moment, the introduction of capacity increasing methods.

The third source of an increase in potential coal is the more continuous operation which modern methods make possible. In America, with rare exceptions, mines have been run upon a single shift. Under the factory system two or even three shifts of eight hours each are frequently found. Since the miner must in any event work by artificial light, there is less of a case against night work than in most other industries. In the great majority of mines the shift in winter time usually begins before daylight and the mine worker has performed his daily stint before the middle of the afternoon. In England the double shift has ceased to be unfamiliar, and in this country it is not unknown. The growth of modern methods will make it more and more common. It is the downright hard luck of the coal industry that a simple change of habits, such as substituting two turns for one, doubles the capacity to produce.

In such increases in capacity as these there may or may not lie a menace. It all depends. Potential coal is not actual output; so long as a mere capacity to produce disturbs no cost-sheets and does not as originally made, the excess capacities were found to be 450,000,000 and 650,000,000 tons. As later figures have shown, the first of these had already been exceeded by the capacity in existence at the time of the calculation.

come to market, it should do no harm. But potential coal can easily be quickened into saleable tons of bituminous. At any moment it may break away to add to an overdone supply, spoil the market, and start the curve of price downward. Unless checked, it may send the unit-price below the unit-cost of even efficient operations, bring a plague of bankruptcy among coal properties, and play havoc with the possibilities of order and economy in the industry.

Whether this deluge of coal can be stayed, or whether events are to take so unfortunate a course, is the next concern of the argument. There are two circumstances which tend to make of increased capacity a great peril. The one is the haphazard way in which new units of capacity to produce come into existence; the other is the steady pressure of overhead costs towards an increased output. There are two barriers which may dam this incipient flood and prevent its destructive work. The one is a possible increase in the demand for coal; the other is the elimination of enough inefficient mines to leave the total capacity of the industry quite right. Is the industry in the period ahead to be dominated by an uncontrolled capacity or will checks and balances hold capacity down to a seemly size? That is the question.

II. HIT-OR-MISS EXPANSION

A circumstance which makes increased capacity menacing is the hit-or-miss way in which it comes

into existence. It would be easy with a handful of agreeable premises, the march of an orderly logic, and a fact or two to give spice, to construct a pretty story of how capacity increases in an orderly way as the increments can be put to effective use. In its terms new capacity comes with an increase in demand or to replace mines too wastefully run to be continued. New mines are opened or old ones expanded by alert and venturesome men who have confidence in their abilities to undersell competitors or in a rosy future for high prices. But; to confuse a neat argument, three of the attending circumstances put the growth of the capacity of the industry to produce well nigh beyond control.

There is, as a first element of confusion, the inability of operators to make the increase in capacity respond shrewdly to the conditions of the market. In bituminous coal the lure of profits cannot bring out increments of supply in an orderly way. This is due primarily to the length of time which must elapse between the decision to increase capacity and the actual offer of coal for sale. If favorable prices seem to indicate an increased demand for coal, a few enterprising concerns may set about reorganizing their mines towards an increased output. But in the months which must elapse before judgments become coal, many others, guided by immediate considerations, and ignorant of decisions which have determined future supply, rush ahead with programs of further production. The lag between decisions and

the proof of their wisdom in the market, as well as a lack of knowledge of the general situation, makes intended increases in capacity the play of circumstance.

There is, as a second element of confusion, the speculative character of coal-mining, most evident in the disposition of operators to view their own prospects quite optimistically. In an unusual degree the industry attracts men who play a little recklessly in the hope of extravagant gains. So general is the tendency of the average operator to account his chances better than the average that for a long time the aggregate of values at which prospects have been held is vastly in excess of the profits which the market has yielded. And, like the faith of the fatalist, who believes that, whatever he does, he will not die until his time comes, the speculator is not persuaded by statistics, which deal only with averages and leave out of account his luck. Every favorable moment is to him a lasting promise. He may, as likely as not, respond to the prod of such an occasion to convert a temporarily favorable market into an improved and bettered and cost-incurring property. So long as operators are willing to pay for the tickets in a lottery a sum far in excess of the amount to be distributed as prizes, the sanguine expectations of the brethren "who also serve with coal" must overdo an overdone capacity.

There is, as a third and far more important element of confusion, the accidental way in which a

large part of the increase comes. It appears, almost without anyone's conscious intent, certainly with little thought about the total capacity of the industry. It comes as a mere by-product of attempts to reduce unit costs in mines already being worked. The manager takes his profits from between costs and prices; he is apprehensive about sags in the price-curve; he turns to the new devices because of the lure of lower costs. The equipment companies, in their salesmanship, entice him with the bait of reduced expenses of operation. Then, when the new processes are running, the operator discovers that his operations are concentrated; that he has a bit too much mine; that if he can keep everything going nicely he will have more coal for sale; that additional tons can be marketed with little additional expense. And, as it is with one, so with others. A great swelling of capacity comes as a by-product of attempts to cut the costs of current production.

So it is. The operator must plan blindly against a future market; the squire must take his chance of becoming a coal baron; and the lure of lower costs must lead producers to swifter methods and better. And with it all the capacity to produce, which is coal-in-the-making, goes skyward.

III. THE TYRANNY OF OVERHEAD

After all, even if there must be a great increase in potential coal, what harm can it do? Is it not a

resource of tremendous value for some great national emergency? It is actual output, not potential coal, is it not, which floods the market, depresses prices, forces concerns into bankruptcy, and disorganizes the industry?

Even if simple and comforting answers could be given to all such questions, it would not speak well for the economy of the industry. The excess capacity represents an investment upon which someone must pay a return, a "freezing up" in idle capacity of resources which might with value be used elsewhere. If operators are reimbursed in receipts from sales for carrying this excess freight, the price of coal is imposing a needless cost upon the community. If they are not, the burden must be carried by adventurers in the industry who pay and get nothing in return. That situation in itself would be evidence of how tangled affairs are in an unruly industry.

But the answers which must be given are neither simple nor comforting. The increase in capacity in the period ahead is to play no passive rôle; instead it is to disturb the policies of operators and confuse the affairs of the industry. This is because the movement towards modernization brings with it "the tyranny of overhead," which forever threatens to turn potential coal into marketable tons of bituminous.

The beginning of the dominance of overhead lies in the innocence or the guile of the operator who decides to bring his mine up-to-date. Whether he

aims at an increase in possible output, or has it thrust upon him unawares, he finds himself possessed of "more mine" than he is used to. Since fewer sections will turn out his accustomed output, the extra capacity is in part a matter of surplus sections. But, since output depends so largely upon how nicely the machines and processes which make up coal-mining are articulated into a going productive system, it is even more a matter of the efficiency of operation. In either event the surplus capacity represents an investment in planning, in equipment, in superintendence. It is a supply, partially produced, which mere out-of-pocket costs can convert into actual output, every ton of which should bring the full market price. It is, in short, partially mined coal.

Since this potential coal is so nearly ready, the operator would like to convert it into a marketable tonnage. In all of his policies, try as he may, he cannot escape the pressure of overhead. The promise of the modern methods is only to one who can fully utilize the new equipment; it has no gains to share with small-scale enterprise. Each cutter, each conveyor, each hoist, each technician must be as fully utilized as may be; their costs must be distributed over the largest possible tonnage. Likewise, the lower costs will be fully realized if, and only if, the operation is kept going. Under the older system where the bulk of expenses were direct, the spasmodic character of work was not of the most serious

consequence in the balance-sheet. Under the new system "overhead costs" have come to demand an end of interruptions. Interest must be paid on equipment whether it is used or not; a complex organization must be kept intact or no ton of coal can move; technicians and petty bosses are paid by the month and miners become "company men" to be paid by the day.³ The tendency is to make the operation so routine in character that whether the machine-miner is paid by the day or by the ton is a matter of indifference. An interruption due to a machine unable to do its work, a process not going smoothly, a break in the correlation of tasks, and "overhead" still refuses to take time off. The annihilation of this excess of capacity within his mine becomes the prime object of the manager's endeavor.

The operator, never quite satisfied with the price of coal, always wishing to spread his overhead just a little thinner, is easily susceptible to arguments for increased tonnage. The first sign of a favorable market, the first upward turn in the price curve, and it threatens to spring into life. And, since the operator is only one of his kind, the result is an increased output, a break in the market, and a decline in price. Each downward sag of the price-curve takes its toll from the per-ton receipts of the operator and decreases the margin of safety, for

³In union fields arrangements have been made whereby the men who operate loading-machines and conveyors are paid on a time-basis. See *Coal Age*, July 24, 1924, p. 107; April 2, 1925, p. 510.

good mines and bad, for the efficient and the wasteful, between unit-cost and unit-price.

More important still, potential coal is more than a threatened increase in output. Potential coal, in a very real sense of the word, is actual coal. It matters not that no lump of it has ever been touched by pick or cutter. It is, in spite of that, like a building half erected, inchoate goods half manufactured, the parts of an automobile not yet assembled. The stuff of which output is to be made is all at hand; the operation essential to its production is going; many of the expenses incident to its appearance in the market have already been met. In fact, that capacity is actual coal is a commonplace in the trade; it is indelibly written into mining practice. For, very little bituminous is sold on the "spot" market; most tons of it are sold and then mined. It is potential coal, not actual output, which is peddled upon the market.

And, if the matter is left to the market, it is capacity to produce, not output, which really counts. Operators can avoid bankruptcy only by keeping total receipts above total expenses, or unit prices above unit costs. The potential coal which lies latent in unused sections of mines, in the better articulation of processes, in operation at a more rapid rate, represents expenses that must be met. The offers of coal on the market, which are of tons still in the ground, decreases prices and diminishes total receipts. In the trade one looks in vain for

a reality which can accurately be dubbed "supply"; its nearest equivalent is capacity to produce, or potential coal.

So it is that the tyranny of overhead steadily threatens to quicken capacity into supply, depress prices, and sweep away margins of profits. But between this persistent pressure and its effect in a chaotic industry, there stand two barriers. The increase in potential coal may be balanced by a growth in demand. The increase in potential coal may be checked by the elimination of enough unfit mines to leave the capacity to produce in the neighborhood of national requirements. Each of these deserves its section.

IV. THE BALANCE-WHEEL OF DEMAND

Will not an increase in demand balance this excess of capacity, as a kindly increase should? More than once, as the history of invention runs, the threat of potential output has been arrested by a great increase in use. When the art of printing appeared, the sale of books and later of periodicals, was not limited to the purchaser of manuscripts. Instead successive inventions with their lower prices resulted in a larger and larger demand until the penny newspaper became a household necessity. So, too, it has been with textiles, with boots and shoes, with cutlery and crockery, with radio and moving pictures. Lately Mr. Henry Ford has insisted that, even with such a luxury as the automobile which he

produces, demand must be adjusted to factory capacity rather than output to demand.

In the bituminous coal industry this does not seem to be an even possible course of events. All household users would be glad to get fuel at a lower price; but few of them are economical when the price of coal is high and extravagant when it is low. In America, there is no large group who would like to have coal and must do without. Nor is there hope of attracting to soft coal those who use other fuels. For the moment oil is winning many customers from bituminous, who at no distant date are likely to be won back. Bituminous must eventually replace anthracite, but it will be some decades before the process, which in the end will add little more than 100 million tons to the demand, is complete.⁴ Since only one-tenth of the annual product of the bituminous mines becomes domestic fuel, these possible additions are of little account against the threatened increase in mine capacity.

An increase in industrial use seems even less promising. The demand for coal for power varies, rather with the volume of industrial production, than with its market cost. It is a function, rather of the stage of the business cycle, than of its price. Strangely enough demand is disposed to be large when price is high and small when price is low.⁵

⁴ Tryon, F. G., and Hale, Sydney A., *Coal in 1919, 1930 and 1921*, pp. 460-2.

⁵ See Chapter IV, "The Spotted Actuality," pp. 71 ff, and Appendix A, "Coal Prices," p. 273.

For this reason the prospect of a great increase in demand lies in the expansion of industry and the larger utilization of power. Engineers, who have fallen into the habit of statistical expression, estimate this increase at 10 per cent annually.⁶ This figure overshoots the mark, since it includes an item of replacement and is based upon past performance rather than upon a reasoned analysis of the probable course of development. Even if mechanical energy should come to be extensively used upon the farm and in the home, the increment added annually to the demand is likely to be small for many years to come.

Nor is there much prospect of building up a large export trade. In recent years our sales abroad have not exceeded 40 million tons,⁷ a small basis for a beginning. In the undesirable and improbable event of taking from Great Britain all of its trade, far less than 100 million additional tons would be added to demand.⁸ What with freights to seaboard points, costs of transshipment, and rates for ocean carriage, it will take a substantial decrease in mine-mouth prices to overcome preference for foreign coals, change habits of use, and turn trade into new channels.

⁶ Northeastern Super-Power Committee, *Super-Power Studies for the Northeast Section of the United States*, p. 5.

⁷ Tryon and Hale, *Coal in 1919, 1920 and 1921*, pp. 550-6.

⁸ British exports of 73 million tons in 1913 fell to 59 million in 1914 and to just over 24 million in 1921. An export of 64 million in 1922, of 78 million in 1923 and of 62 million in 1924 shows a return to the "pre-war level." See Mines Department (Great Britain), *Annual Report of the Secretary of Mines for 1921*, p. 115; *Annual Report for 1923*, p. 4.

Even this sombre account fails to make black enough the future of the demand for coal. The demand varies with industrial use, and the extraction of power from coal is an art which is not beyond improvement. It has been estimated that of the 2,000 pounds of coal which reach the tippie, 120 are consumed in transportation; 18 are lost en route to the boiler room; 809 represent waste in firing; 943 are lost in exhaust steam and friction; and 110 are converted into usable mechanical energy.⁹ Some of this waste is, of course, inevitable; with technique as it is at present, far more of the energy that is coal must be lost than is utilized.

Just now these wastes are the objective of a series of advances in the use of fuel. The campaign for making "coal go further," conducted by the Fuel Administration during the war, is still producing results.¹⁰ A large city recently had a committee of experts make a survey of current practices and draw up a program for the utilization of its fuel.¹¹ Boilers are being constructed which are better adapted to the requirements of plants and which extract more power from the coal consumed. Stoking is coming

⁹ Calculated from figures given by George Otis Smith, "High Price an Incentive in Inducing Thrift in the Use of Coal," *Coal Age*, Nov. 11, 1920, p. 999. The figures given here differ from those given by Mr. Smith because they are calculated on a different base. The percentages are the same.

¹⁰ U. S. Fuel Administration, *Fuel Facts, Saving Steam in Industrial Heating Systems, Saving Coal in Steam Power Plants*, and other pamphlets.

¹¹ Brewer, G. S., and Hatmaker, B. J., *A Fuel Program for the City of Buffalo*.

to be something more than a series of motions without an objective. Careful attention is being given to the form in which coal is fed to the furnace. Briquets and pulverized coal are gaining in favor. While their use is still small, they give evidence of an increasing demand for sizes for which it has been hard to find a market.¹² In all of these lines research work is rapidly going forward. Since a saving in the coal bill seems to the manufacturer so much clear profit, he has every incentive for an attack upon waste.

A growing discrepancy between figures of the total volume of industrial production in the country and the demand for coal has recently been remarked. Some stray items from the trade prints help to rob this matter of its mystery. In 1924 the railroads transported twice the number of tons of freight carried in 1914 with an increase of only two per cent in the amount of fuel used. Evidently the process is not at an end, for in a single month of 1924 there was a saving by Class 1 railroads of 10 pounds of coal per 1,000 ton miles over the same month in the preceding year.¹³ Again, although the output of electricity in 1924 was larger than in 1923, 6 mil-

¹² U. S. Bureau of Mines, John Blizard, *Preparation, Transportation, and Combustion of Powdered Coal*, Bulletin 217; and H. Kreisinger, J. Blizard, C. E. Augustine, and B. J. Cross, *An Investigation of Powdered Coal or Fuel for Power-Plant Boilers*, Bulletin 223.

¹³ Haring, M. A., "Trouble Ahead for Both Hard and Soft Coal," *The Annalist*, Jan. 5, 1925, p. 19.

lion fewer tons of coal were required to produce it.¹⁴ Since the railroads and electric industries use towards one-half of our coal, the figures given are not scattered items. The hope for an increased demand for coal, if hope there can be, lies in "the discovery of new uses for it."¹⁵ But the only new use which a diligent search through trade periodicals reveals is "to cool houses" in summer.¹⁶

An even greater threat to demand lies in the series of developments loosely thrown together under the name of "super-power." Four separate but closely related movements towards a more economical use of coal are going forward. The first, the replacement of a multitude of small boilers by a few larger power plants, promises less waste in the conversion of coal into power. The second, the substitution of hydro-electric power for coal, will yield some economies. But the potential water supply, and its seasonal irregularities impose rigid limits upon its use.¹⁷ Engineers estimate that only one-tenth of our increased demand can be supplied from this source. The third, the location of power plants at nine-months, seems to have a future. For the moment it is hampered by two serious difficulties. One is that, limited by current knowledge, trans-

¹⁴ Aylesworth, M. H., "Prosperous Year Indicated for Electric Plants," *The Annalist*, Jan. 5, 1925, p. 20, "The saving was slightly offset by a small increase in the use of oil."

¹⁵ *Coal Mine Management*, March, 1925, p. 33.

¹⁶ *Coal Age*, Oct. 2, 1924, p. 462.

¹⁷ Northeastern Super-Power Committee, *Super-Power Studies for the Northeast Section of the United States*, pp. 8-9.

mission is cheaper than transportation¹⁸ only within a radius of 200 miles.¹⁹ The other is that, since 5,000 tons of water are used for every ton of coal converted into power, such plants can be located only upon the sea-coast or upon large rivers.²⁰ The fourth, the linking of power plants into regional services, allows companies to tap each other's wires, makes possible a pooling of daily and seasonal supply, and permits an adjustment of demand and supply over an extended area.²¹

It is impossible to secure detailed statements of the net savings likely to be effected by "super-power." An approximate estimate is at hand for only one section, which by lucky chance is the Northeast. This, in terms none too definite, reckons a saving of 50 million tons easily attainable.²² But it does not specify the savings from each of these four economies. If conditions in the Northeast are conditions the country over, the total figure is about

¹⁸ An argument against "super-power" is that the location of plants at the mines, by the elimination of coal carriage, will seriously disorganize the transportation service, and bring bankruptcy to several coal-carrying railroads as well as threaten the solvency of railroads in general.

¹⁹ This figure of 200 miles is most uncertain. The Northeastern Super-Power Committee arrives at it on the basis of the most arbitrary assumptions about costs. For example they use current railroad rates as costs of transportation. This figure may be invalidated, not only by an increase in technical knowledge, but by changes in the prices of the various items which make up the cost comparisons of transportation and transmission.

²⁰ *Super-Power Studies for the Northeast Section of the United States*, pp. 7-8, 10-11.

²¹ *Ibid.*, pp. 6-7.

²² *Ibid.*, p. 8.

100 million tons. But time is of the essence of the problem, and engineers are silent if asked when these economies are to become real.

When all this evidence is brought together it defies reduction to a quantitative statement. With the growth of the country there must be a slow but steady increase in the demand for power. But this does not mean an increase in the demand for coal; for in recent years economies in the use of coal have probably more than cancelled the effect of new uses, and even greater economies are promised for the future. Besides, while super-power is not the giant of the fairy tales of technology, it does promise substantial savings for many years to come.

Yet, in spite of an absence of usable decimal points, the meaning of all this is perfectly clear. At present there is an excess mine capacity of nearly 500 million tons. The introduction of modern methods threatens from time to time the addition of new increments to a supply of potential coal already overdone. Under the conditions ahead there is little chance for demand, arrested by a more skillful use of fuel, to balance a mounting capacity to produce.

V. THE SURVIVAL OF FIT AND UNFIT

If, then, the balance is of no avail, what of the check? If demand is to be of scant service, will not the market eliminate enough wasteful operations to make room for efficient ones? Will not good mines

replace bad ones to the lasting good of consumers and the better repute of the industry?

Many times, as experience goes, the progress of the industrial arts has been followed, sooner or later, by such a proper course of events. The addition of an increment of efficient establishments has been accompanied by the disappearance of wasteful ones. The modern coking plant is making a luxury of the bee-hive oven, the old glass-blowing industry was superseded by a modern one, up-to-date flour mills left the old water-wheel to rot in the pasture. The opening of the West made it unprofitable to cultivate many New England farms. Around the turn of the century new textile factories replaced old ones in England. In every event the process was painful and for a time there was confusion; but in each instance a more economical and not less orderly industry appeared. Whether the case of coal is to be an oft-repeated story depends upon how nearly insolvency wipes out all the operations which would never be missed and upon how skillfully it chooses its victims for bankruptcy from among the inefficient.

If, in the events ahead, enough of the wasteful are to fail to keep the industry at proper capacity, the task must fall to the market. It requires fewer syllogisms than even the economic amateur can muster to show that, under competition, a price must be fixed which approximates the cost of production of the most expensive increment of supply

which is required to meet the demand. The marginal establishments just manage to keep going; better ones wax fat because of lower costs; worse ones are shuffled out by higher expenses. Moreover, as efficient capacity comes into the industry, the supply can be taken from better mines, the cost of the last necessary increment is decreased, the price is accordingly lowered, and another group of high-cost mines drops out, to leave the industry more orderly and more economical.

Now, if such a check upon increasing capacity is to prove effective, high costs must keep wasteful capacity out of use. The task is no simple one; for the market is a business, not a technical institution. Its decrees are based, not upon engineering practice, but upon accounting records. The market does not smile upon up-to-date establishments and frown upon those that make an office of waste. Instead its rewards are for low-cost and its penalties for high-cost mines. If, then, the process of plucking the unfit and enough of them is to be reasonably accurate and reasonably thorough, the expenses of production of competing units must present a fair likeness of their relative abilities at efficient performance.

In the coal industry, costs reflect practices in the crudest sort of way.²³ Under the business control of the industry not even a reasonable harmony can

²³ See Chapter IV, "The Spotted Account," and Chapter VII, "The Lure of Lower Costs," pp. 154 ff.

be established between wasteless methods and low costs. Inefficiency may, and usually does, lead to insolvency. This, however, generally marks the end, not of the mining operation, but of the business venture. The more likely event is not the closing of the mine, but its resumption, after a short period of idleness, under a new business control. Since it can start afresh with many technical resources not represented by capital charges upon which interest must be paid, it may have a competitive advantage over its efficient neighbor.

Nor do reorganizations give the only chance to the inefficient to lighten their over-heavy loads of expenses. Impending disaster, or even the prospect of it, may be equally efficacious. The wasteful concern may slough off or pare down some of its out-of-pocket expenses. For a long time a scheme of wages, lower than those usually paid, has enabled operators to keep sub-marginal mines going. So established is this practice that the term which characterizes it, "the thin-seam differential," is in general use throughout the trade.²⁴ At present the lower wages paid to non-union miners are a factor of importance in determining what mines shall be operated. A like role in twisting costs into an unfair picture of the state of waste and efficiency, is played by car supply, by transport facilities, by railroad rates, and by similar devices.²⁵

²⁴ Lubin, L., *Miners Wages and the Cost of Coal*, pp. 92 ff.

²⁵ See the discussion of The Manager's Problem, in Chapter VII, "The Lure of Lower Costs," pp. 145 ff.

In fact, so general is the practice of revising costs to aid inefficiency that an idea, called "competitive equality" has won a large measure of acceptance within the industry. In its terms, which seem far removed from the system of free enterprise, rival concerns should have equality in "competitive conditions." This means that if some obstacle stands between a concern and its market, some cost should be revised to give it an equal chance at the market. In such an industrial democracy all mines, whether they be efficient or wasteful, whether their technical costs be high or low, are to enjoy the same chances at the market. This theory, of course, has never dominated the industry. But with every concession to it, the ability of the market to put an end to surplus and unneeded operations is impaired. It is enough that it interposes real obstacles between inefficiency and the great wrath of inexorable cost accounting.

The further to confuse the process of eliminating the unfit, with the march of the new technique it becomes increasingly difficult to draw a line between high-cost and low-cost mines. Because coal-mining is usually addicted to a hand-to-mouth procedure, solvency is far more a matter of an everyday favorable balance than of shrewd calculations over a period of years. In an inefficient mine, which starts operations without planning, costs are for a while extremely low; as its periphery widens, they increase. Thus, if waste gets the chance to ruin its

practitioner, the harm may be done before the decree is enforced. In an efficient mine, where the whole procedure is planned in advance, initial costs are very high; they increase little with development. Where the long-wall retreating system is fully employed, and a drive is made to the boundary and coal is taken on the way back, the unit expense of production may actually decrease with output. Such mines, however, constantly demand investment funds that cannot yield an immediate return; their operators may face serious difficulties in commanding capital at a time when the promised land is just in sight.

In addition, the very way in which increased capacity appears tends to wipe out the line between high-cost and low-cost operation. The new capacity does not come into existence as so many new mines. Instead, because of the accident of its origin, it is all jumbled up with the old. The question is not so much a choice of what mines shall produce coal and what shall not as what part of the capacity of each shall be used. In a hodge-podge of establishments which can turn out far more coal than the market can take the unit cost is low if the mine is run towards capacity, and high if operations are irregular.

Here the competitive system and the diffusion of mine capacity create a beautiful paradox over which it is well to hurry. The promise of competition is that the upright in technical matters shall prosper.

Operators are told to get their establishments in order. The market is appealed to to eliminate ventures whose high unit costs mark them as inefficient. And yet, where capacity is diffused, unit costs are low if custom permits operation towards capacity and high if its absence forbids. Lo, it is the market, not the devotion of operators to the creed of efficiency, which gives high costs or low; it is the judge who creates the facts of the case. With demand scanty and capacity diffused the market must be a shrewd detective to break through such barriers of cost to choose backward establishments for the bankruptcy court.

The result of all this must be a gross and impulsive growth of the industry. The over-expansion of the industry, so erroneously called over-development, has been noted time and again in the annals of coal. The late Coal Commission merely repeated what others had said before when it declared for birth-control for mines.²⁶ A quarter of a century has witnessed an increase in excess capacity from 100,000,000 to 500,000,000 tons. This has been due in some part, as the experts insist, to amateurs who must have a fling at coal-mining. But a far more significant cause is the increased productivity given to established ventures by their zeal for cheaper and better methods.

In the past mild inroads of efficiency have made surplus capacity a source of confusion in the indus-

²⁶ U. S. Coal Commission, *Final Report*.

try. At present a capacity to produce double the amount of coal the country requires presses silently and steadily towards over-production, irregular prices, and sporadic operation. It has already, more than once, sent the curve of price below the curve of costs, even for efficient mines.²⁷

In the absence alike of a proper balance and an effective check this excess of capacity must remain. Nor can the industry escape its consequences. Under a system in which the item which most nearly represents supply depends upon the judgments of many operators, there is no adequate check upon production. When all the coal that is needed can come from one-half the working-area, it is a task to keep those who control the unneeded other half from offering coal in the market, especially since they are so largely the same people. When a needful output can be taken from one-third of the mines, a real struggle must determine what enterprises will survive. When many concerns have no costs to guide them; when a temporary overproduction can reduce price below cost in up-to-date mines; when reorganization will enable the inefficient concern to slough off a capital charge and start afresh; when many devices are at hand to preserve competitive equality between operations that differ greatly in efficiency; when adventurers who know neither overhead nor the accidental source of increased

²⁷ See Chapter IV, "The Spotted Actuality," and Appendix A, section on "Coal Prices."

capacity invade the industry, potential coal must remain an element of disorder. Its reputation for disturbance is well established; its repute must grow more and more notorious with the onward sweep of the machine process.

Of course even potential coal might one day be domesticated. There is a movement towards consolidations within the industry. Of late there has been talk of "combine," and newspapers have published rumors of "a billion dollar merger" of competing operations. This movement, if it gains headway, might eventuate sometime into a unified control of the coal supply. That would turn the trick, but it would bring a host of new problems. Besides, it would mark the end of competition in the industry. There is a growing tendency for the users of coal to make sure their own supplies. It is apparent all along the line from steel-mills to mail-order houses. It might eventuate afterwhile in a complete dismemberment of the industry, and its apportionment in bits large and small to the industries which it furnishes with power. That would end not only the regime of competition but the industry itself. Such possibilities, however, are far removed from the dilemma into which circumstances like these are driving the operator.

One may, if one will, still believe that with the coming of modern mining high-cost will be replaced by low-cost capacity; that the market will, after a period of confusion, adjust total capacity to the

demand for coal.²⁸ One may; but such an exercise in faith has no place in a sober recital of the case of bituminous coal.

VI. THE OPERATOR'S DILEMMA

The effect of countless individual judgments is creating a situation in the industry which the ordinary operator finds it increasingly difficult to take into account. He is, unless he is shrewder than the average of his kind, in a position where he is sure to be impaled upon one or the other of the horns of a dilemma.

Shall he modernize, or shall he not? He can answer "yes" or "no." Either answer makes his wisdom dependent upon the actions of his brethren in the industry. If the answer is "yes," he is safe, and probably sure of an earthly reward, provided all others, or enough of them for the purpose, refuse the machine admission to their mines. If the answer is "no," he is safe, and probably sure of his customary profit, if all others, or enough of them to secure the result, with him resist the alluring arguments of the sellers of coal mine equipment. But if others in the trade, in sufficient volume and with sufficient zeal, yield to quantity production, as the radical bloc in increasing numbers is sure to do, the way to

²⁸ For evidence of how well the market has succeeded in eliminating the unfit and granting survival to the fit see Chapter IV, "The Spotted Actuality," pp. 61 ff. For recent events see Chapter XI, "The Prevailing Drift."

solvency is more than scripturally straight and the gate is possessed of more than a biblical narrowness.

Since each is at the mercy of what others do, it would seem imperative for all in the industry to make common cause against the common dangers. Yet collective action of almost any kind is pent in by barriers that are not easily broken down. A consolidation of properties into larger undertakings could bring no release from the pressure of surplus capacity so long as each of these corporations was driven by overhead towards production at capacity and all of them were competing for markets. A combination with the avowed purpose of guiding the industry quite consciously through the crisis would run afoul of the anti-trust laws and would stir up hostile public opinion. An informal understanding among coal producers to have nothing to do with the new technique might prove effective if all should agree and no one should change his mind. But the greater the number who consented, the larger would be the promised rewards to those who introduce the new methods. In a competitive situation and in an industry which has never known action by unanimous consent, such a program of conscious sabotage against the new methods cannot be maintained. An appeal to an external authority seems equally impractical. To expect 29 states of the union in 29 separate enactments to rescue an industry in distress is credulity. To look to the federal govern-

ment for immediate assistance is to overlook the current limits of its jurisdiction. Thus, if concerns are impelled to save themselves through united action, there is nothing worth the doing which can easily be done.

As matters currently stand it is a case of each for himself, however many the devil takes and however clumsily he chooses them. In the crisis ahead whatever happens to the industry the individual management must seek self-preservation. Its primary concern must be to maintain solvency; its secondary task to take from the shifting situation such profits as it will yield. It must build such barriers as it can about its own markets and costs; it must stay as well as it can the serious effects of the potential deluge of coal which will forever be in the offing. The game is to beat the game.

In this situation the shrewd or the lucky business may survive. If a concern can introduce machines, eliminate waste, unify productive processes, and produce coal at a low unit cost, it has a great advantage. It should, until enough concerns have followed, take large profits from between prices and costs. If the size and number of its operating units are fixed with a real regard to the market for its coals, it ought to be able to weather periods in which prices are unduly depressed. If it can foresee the inevitable occasions when low prices are sure to lead, at least for a time, to low production, it should reimburse itself for unavoidable losses. In these,

and like ways, by "getting the jump" upon competitors, the efficient concern may even prosper during a protracted period of disturbance in the industry. Luck, too, might turn the trick; for a favorable "break" is any day worth a shrewd judgment.

But such safety is only for the select. The threat in large potential capacity to produce, through irregular markets and low prices, will limit rewards to the few. The ordinary management could not turn even complete knowledge into a wise series of decisions. Its policies must be based, not only upon technical, but also upon economic considerations. Since technical truth finds expression in physical processes, and is not quickly out of date, it is easy to determine the technically correct thing to do. But the economic considerations are the treacherous and shifting facts of a highly competitive situation. Here it is that safe judgments know nothing of the absolute.

The highly competitive situation prevents the ordinary manager from winning. It includes as its most important ingredient the sum of the results which flow from the policies of all who mine coal. A sound decision by one may bring affluence to him who made it; it may permit a bare escape from bankruptcy to several who have made it together; it may consign to a common ruin the many who made it in concert. Hence, it is the essence of wisdom to make a sound judgment early, of folly to do a wise thing too late. Where safety is promised only to the ex-

ceptionally alert, there is no escape for one who in technical matters is only ordinarily righteous. The privilege of reaping the rewards from differing from the majority is accorded only to the minority. The average entrant cannot win a game whose objective is to come in ahead of the pack. The average management cannot rise to superlative business judgments. The ordinary manager of the average concern, because he is an ordinary manager, can make only ordinary judgments. Where success is for those who excel, the fate of his venture must be the ordinary fate.

Nor will it avail the concern to attempt to escape by trimming necessary costs. For a moment temporary relief may be had by securing favors in railroad rates, by reducing wages, by sacrificing safety standards, by imposing costs upon anyone and every one who may be forced to assume them. Such devices merely tempt competitors to go and do likewise. They give no real surcease from the disorganizing pressure of over-capacity; for, once they become universal, the demand of rivals for more markets than are to be had becomes as insistent as before. The only net effects are lower prices, lower costs, and a lower plane of competition.

Thus the manager of the ordinary coal concern must make a decision which cannot be made. If he elects not to mechanize, he is doomed with the high costs of an obsolete technique in competition with those who do. If he chooses the modern ways, since

many others will also do so, he is equally certain to fail to get orders enough to make the increased overhead endurable.

Amid all the perils of quantity production there may be a way of escape for the elect. But in the immediate future there can be neither profits nor solvency for the many because they are the many.

CHAPTER IX

THE IMPOTENCE OF COMPETITION.

To one who to tradition clings
This seems an awkward state of things.
—*The Bab Ballads.*

I. THE COAL CYCLE

There remains, to complete this discussion, a perilous venture in prediction. The argument requires that all of this evidence be turned into a statement of the rate at which machine-mining will invade the industry. The factors that shape the situation are so many and the alternatives so numerous that a statement of the exact course of events can be little more than a surmise. Yet a generalized picture of what is ahead seems to stand out in clear relief.

These seem to be the certainties. The new mining will not be arrested at the frontier of the industry; there are too many enterprising manufacturers of equipment, too many competent technicians, and even too many progressive operators for that. There will be no catastrophic conquest of the industry; the "cake of custom" hangs far too heavily over the mass of coal operations for that. Price, competition, and the other instruments of free enterprise are to be vital factors in a developing situation; but the

conditions are so unlike those under which they are reputed to work that their effects will be towards disorder. As a result the new mining, certain to come faster than it has in the past, will invade the industry in a series of fitful interrupted movements. There is likely to appear, if anything so disorderly can be dubbed with such a name, a "coal cycle."

The cycle, if such it is to be, will run somewhat like this. In an industry already overexpanded, a number of progressive operators will invest in improved equipment and better organization. The pressure of overhead and potential output against a lagging demand will cause prices to fall. Since the demand for coal does not increase with a fall in price and is powerless to stay its decline, the break in prices will be out of proportion to the increase in quantity. The price will be driven far below the expenses of production in the higher cost mines and for the time perhaps below those in very efficient ones. The visitation of bankruptcy is likely to fall upon some efficient as well as many inefficient concerns.

This situation will for the moment halt the onward sweep of the machine process. Some bankrupt concerns will find it impossible to resume operations. Others, with capital charges reduced by reorganization and possibly under new managements, will continue mining. Still others, with resourcefulness in accounting methods and in a sluggish labor market, may be able to pare down or snuff out bother-

some expenses. But the policies of all are likely to be traditional and caution the watchword of expenditure. For a time many concerns, particularly those in which costs are still largely direct, will operate only when they are certain of a market. For a while few will wish to tie up good money in new methods and contrivances, and fewer still will be able to secure the investment funds with which to engage in so uncertain a venture. So the invasion is checked, for the moment order seems to be just ahead, and tongues begin telling of the coming return to "normal conditions."

But the arrested movement must get under way again. The failure to purchase new machines stops the increase in capacity,¹ the failure to renew equipment may decrease it. What with idle mines, timid policies, arrested development, and financial retrenchment, there will be a reduction in supply and, for the time, a return to higher prices. It will occasionally happen that prices are above the expenses of production in even high-cost mines. For a season not likely to be protracted, the whole indus-

¹ The following item taken from *The Associated Press*, for Jan. 5, 1925, p. 19, is a straightforward bit of evidence, indicating clearly the stage of the "coal cycle" current at the time. "The bituminous mines purchase each year about \$400,000,000 of equipment. The attempt to reduce costs assumes, naturally, the form of added mechanical equipment for the mines. Equipment makers, however, have been just to learn what has been a surprise. Selling prices have sagged so low that even strong companies feel the need of cut-throats. Equipment of the mine sort requires possibly eight months, on an average, for delivery after order is placed. Orders are not being placed for 1925 deliveries with anything like the volume of a year ago, and less equal to that of two years ago."

try may enjoy reasonable or even extravagant profits. Then, just at the turn, the more enterprising concerns, followed a little later by less enterprising ones, will embark upon a course that leads to over-capacity, an increase in potential output, and a great drop in prices. Then the cycle is well on its way towards another round.

The coal cycle may come once; it will probably be repeated; it is most likely to run its course many times over. Six factors seem to guarantee its repeated coming. One is the sheer inability of real costs to keep out of the industry adventurers with funds large or small who play at coal mining for a gambler's high stakes. A second is the kindly help given to the inefficient by bankruptcy laws that leave the door open for reorganization and by other artful devices by which pecuniary costs may be low though mining methods be wasteful. A third is the sheer power of the machine to persuade new operators to give it a foothold in their mines at the first sign of the return of prosperity to the industry. A fourth is the diffusion of excess capacity among many mines which blurs the better part of the line between low-cost and high-cost operations. A fifth is the kindly help given by thrifty bankers who "know" that investments in instruments and processes which are certain to reduce the unit costs of production are safe.² And a sixth is the irregularities which mark

² Note the confusion in the following typical statement: "I am unalterably opposed to creating new production until demand and

the business control of industry and which we call business "cycles." These, one and all, will leave their lines deeply implanted in an even more confused "coal cycle."

II. COMMON SENSE IN JEOPARDY

The plain truth of the matter is that the scheme of arrangements which we call the competitive system was never intended to take care of such a tangle as this. Its presumptions belong to a world in which change is slow, the industrial arts are progressively developed, improvements are now and then opportunely made in ancient crafts, and the new gives time for graceful accommodation. It takes for granted an orderly industry, made up of well-run establishments each doing its best under the direction of an alert manager with one eye on markets and the other on costs.

Into such an industry it was safe to allow innovation to come. At first a single enterprising concern, or at most the select few, would introduce improvements. Each, by doing so, would lower its costs a little. This would make possible a better price, an increase in demand, and a larger output. It would

potential output are more nearly in balance. But there are other reasons for giving financial backing to coal companies which are, in my opinion, perfectly legitimate even in these times. For instance, to refund maturing obligations; to furnish additional working capital; to install machinery which will reduce cost, and finally, to assist in the merging of competing companies for the good of all." Cassatt, Robert K., *Coal Age*, June 25, 1925.

enable the enterprising producer gradually to cut into the custom of the inefficient. In course of time a few more establishments, less progressive only than the pioneers, would introduce the new methods. So, again and again, an orderly cycle would run its slow round towards the common end of a more economical and no less orderly industry.

Nor was expansion likely to be overdone. The improvement in technique would insure a lower unit cost. To it the capacity of the establishment would in course become adjusted and a competitive struggle would leave in its wake just about the number of establishments the market required. Then, in an industry again normal after a change in the industrial arts, the law of diminishing returns would decree that additional output be accompanied by a slightly increasing unit cost of production. This would tend to check expansion, to hold growth within bounds, to allow the producer shrewdly to feel his way along, to keep the developing industry well within the control of individual business men.

The current realities of the bituminous coal industry are another matter. Here change is fast; a machine-process slowly developed in other industries appears ready to be converted into a new art of mining; and the demands of innovation allow little time for even a perspective of the situation. The industry is in confusion; its establishments are of varied degrees of efficiency; its managers have to take a chance on the new mining or the old with an im-

perfect knowledge of their costs and with little understanding of the larger situation.

The pecuniary guidance of costs is of little avail. The reduction in expenses promised by the new technique are so extravagant as to tempt the poor operator towards increased capacity whether a sober second judgment would approve or not. Nor is there a proper check on capacity; for the operator who has modernized finds that low unit costs go with larger production, and is tempted to increase output. The motor and brake of the competitive system, which permitted one to choose an orderly course, are replaced by a double high-powered motor.

In such a situation, price likewise fails to offer a trustworthy beacon. A high price persuades an operator to increase capacity that he may the better meet the demands of the market. But long before his additional tons are for sale, others have yielded to similar persuasions and there is an oversupply. A lower price offers less inducement to curtail if the mine has been modernized, for overhead must be paid, and tonnage is necessary to pay it.

Price has an established reputation for ending discords between capacity and demand, induced by the disturbances which must attend change. The presumptions of the doctrine of "leaving it to competition" seem to fit in best with an earlier agricultural situation, with its simple technique, its direct expenses, and an increase in unit costs with a growing output. Its fame was won and its effective work

done in a world far removed from the coal fields of today. Its repute is not to be enhanced by recent happenings and events in prospect in the bituminous coal industry.

Even costs and prices together cannot eliminate the wasteful and leave the fit to possess the market. The unit cost is too fitful a thing, too uncertain to discover, too easy of manipulation, and too dependent upon the caprice of a scanty demand to help price pick for the slaughter the sinner against efficiency. In the simple presumptions of competition, an enterprise caught between high costs and lower prices was doomed. Amid the strange conditions in the bituminous coal industry, the task essayed by the market of finding out the inefficient becomes a game of blind man's buff.

Nor is it fruitful to appeal to time to put the affairs of the industry in order. No one knows what time might eventually accomplish; but a fragment small enough for human use could do nothing. If the situation were a simple mechanical one, and if each innovation could find an orderly place for itself before another appeared, competition would doubtless prove adequate. But the current situation is a continuing process. It contains no element that will abide; each factor is in flux as the industry is swept into an unknown future. The new technique must undergo a long development before it is perfected; its adaptation to conditions underground must be protracted; it will take many a conversion to "the

gospel of efficiency" before all surviving operators are numbered in the radical bloc. A diluted lump of capacity, large enough to supply the country with double the amount of coal needed, will not soon resolve itself into distinct productive operations with definite unit costs, to the end that fit mines may be kept and unfit ones be eliminated. Instead, an improvement in methods is likely time and again to dilute capacity and put off to a protracted tomorrow the appearance of order. The sum of hit-and-miss judgments by ordinary operators keeps the industry in disorder. The disorder of the industry makes the judgment of the operator a hit-and-miss affair. The closed circle of a chaotic industry making folly of human judgments and unwise decisions keeping the industry in disorder cannot be broken by the rule of competition.

The mass of uninformed judgments in an uncontrolled industry must result in a strange series of events. There is, in serial order, a rush for the technological bandwagon, an increase in a productive capacity already overdone, a sag in the price curve, a plague of bankruptcies, an arrest of the machine invasion, a rise in prices that persuades optimists that normal conditions are at hand, and the beginning of another "coal cycle." All of this puts the ideal of "a nice and compact coal industry, made up of just enough mines to supply the nation with its coal, and each of just a size to use its resources with the greatest economy,"—far, far away. In the

texts of the future "the coal cycle" may well become a classic example of what befalls an industry when competition, technical revolution, and the dominance of overhead costs are thrown together into a single economic medley.

CHAPTER X

THE CRISIS FOR LABOR

To sit in solemn silence in a dull, dark dock,
In a pestilential prison, with a life-long lock,
Awaiting the sensation of a short, sharp shock,
From a cheap and chippy chopper on a big black block!
—*The Mikado.*

I. THREATS AND PROMISES

The workers in the mines hold no strategic position in the present crisis. It does not fall to them to make the decisions which speed the machines on their way or retard their course. Their voices count for little in bringing or averting the impending chaos. But there is no group in the community more interested in the machine invasion than the 700,000 men of diverse races and creeds who depend upon the coal industry for their daily bread. The machines have promise for them, no less than for the management; they carry threats to the mine workers more serious perhaps than those which they hold over the heads of the titular rulers of coal.

The most dramatic threat in the wake of the machines is unemployment. For the new technique will reduce the industry's demand for labor. Nor can those who escape this danger avoid all loss. The

new machines take over part of the miner's work, force standardized methods of production, and make the workers' jobs bear little resemblance to the work they have always done. They make of little value the training and skill acquired by years of experience; they destroy the freedom to make decisions and the individual independence which have been a noteworthy characteristic of the old mining.

But perhaps the promised gains overbalance the losses. Work should be more regular in an industry in which overhead costs play an important role. The isolation on the job must give place to companionship; the muscular effort required will be reduced. The chance of death may be lessened, for the roof, which now kills so many by its falls, need not stay in place so long. Above all, there are enormous savings to be wrung from waste which offer possibilities of higher wages than have yet been known.

Such are the threats and promises of the new technique. If all were an inseparable part of technical change, there would be little more to be said. We might indeed seek methods of compensation for workers adversely affected, but we could trust the promises to take care of themselves. Unfortunately, however, the inability of free enterprise to cope with the problems of technical change exacts its toll from the mine workers. The impending chaos makes the threat of unemployment doubly severe, endangers the very labor standards the new technique promised to raise, threatens to destroy group control

through the pit committee at the very time when the requirements of the new mining take away the individual's control over his own job, and raises grave doubts about the place of the union fields in the future coal industry. Each of these dangers is sufficiently serious to deserve separate consideration.

II. THE LOSS OF A JOB

The mechanization of the coal industry must reduce the amount of labor needed to produce a given tonnage of coal. How many workers the industry will use when the transition is over cannot be told, but rough calculations indicate that coal in excess of current demands could be mined by 150,000 to 250,000 workers.¹ An impending reduction of the working force, even eventually, to any such number raises important questions. Does it mean that large groups of miners must lose their jobs? If so, on whom will the blow fall? Will it mean unemployment for the workers discharged or can they count on immediate absorption into other industries? What costs will loss of a job entail? Will these be the minimum costs necessary for transition to a machine industry?

These questions cannot be answered by an appeal to the records of history, for the experience of other industries. True, American history records few cases in which technical change brought serious unemployment for the workers. But in many instances

¹ See Appendix A for basis of these estimates.

the industries affected were able to increase the demand for their product so that no reduction of the labor force was necessary. And the technical revolution came to most industries in a period of great industrial expansion, when workers released by one industry were wanted in others. Unfortunately for the miners, this is not the case of coal. It has its own peculiar difficulties, which are tied up with the disorderly character of the machine invasion.

What will the plague of bankruptcy for coal corporations, the "coal cycle" which seems about to out-cycle the business cycle, and the whole confusion confounded mean to the surplus workers? Bankruptcy for corporations affects the workers, quite as much as the investors or managers. It brings periods in which the miner's job has none of the attributes that make a job worth having. It will provide him with work and the opportunity to earn only a few days in the week and those not to be counted on. To some of the workers such jobs will seem worse than none, and they will not wait for the mine to close to seek work elsewhere. Those who stay until the end may find it bitter indeed, for when the mine closes the corporation may not be able to meet the last payroll. Many a miner may find himself in the position of having toiled merely for the common good.²

The uncertainty attending the future of any par-

² See reports of miners waiting for their pay from bankrupt mines in *United Mine Workers Journal*, May 1, 1924, p. 13; *Coal Age*, May 22, 1924, p. 790.

ticular mine adds to the workers' difficulties. For they have no means of knowing whether the mine that closes down today may open up, if not tomorrow, at least a month from tomorrow. Nor can they tell that the loss of a job in one mine means the loss of a job in the industry. It is part of the chaos that new mines will be opening and some mines will be increasing their force at the very time that others are closing down. As to which of the many mines operating today are destined to form the operating units of the new industry, the miner can only guess.

Thus those who go and those who stay may pass through periods of watchful waiting with little or no work, periods of peddling their labor from mine to mine, sometimes with success, sometimes without. A miner's life may contain only one such experience; more likely it will contain many. For the cycles of crisis and activity which seem destined to mark the course of the machine invasion will mean periods in which thousands of workers are cast out, alternating with periods in which many are called back only to be released at the next turn of the wheel. The cyclical character of the machine invasion likewise increases the difficulties of rapid absorption into other industries. Since the demand for coal obeys the ups and downs of business activity rather than the enticements of price, the periods of most acute distress in the coal industry seem fated to coincide with periods of business depression. This means

that the mines will be getting rid of workers when all industries are doing the same. Miners will find themselves looking for new employment at the very time that no jobs are to be had and the ranks of unemployed are already over large. In these conditions immigrant competitors will not be missed. The worker released from mining will be unusually lucky if without a period of unemployment he finds work in another industry.

The human costs attendant upon loss of a job may be neglected by those who think only in pecuniary terms. They cannot be ignored by those who would really consider the effects on the workers. In addition to the problems which all wage earners face when they lose their jobs, the miners have certain peculiar difficulties. Most of the mining communities are single industry towns, many of them at some distance from industrial centers. This means that the miner who is thrown out of work is in a poor position to learn of other opportunities and consequently is likely to be unemployed for some time after the mine closes down. Even after work is found he must add the difficulties of adjusting himself and his family to a new environment at home to those of adjusting himself to new work. This adjustment is probably more serious for the miner than for the factory worker. Work in one factory is much more like work in another than work in a mine is like that of a factory. "Once a miner, always a miner" expresses common recognition of this fact.

These are hardships that cannot be avoided if the coal industry is to be reduced to order. It is to the interest not only of the users of coal but of the workers themselves that mining employ no more men than its needs call for. But the human costs may be minimized if those who are released are those who can best afford to go. For loss of a job means more to some workers than to others. In general, it means more to the 435,000 married men than the 215,000 single ones; more still to the 400,000 who are maintaining homes, and even more to the 120,000 whose families number six and more persons. It is harder for the 135,000 who have passed the age of 45 than it is for the 170,000 who have not yet reached 25.³ It means more to those miners who have grown up in the industry than it does to those who have just entered it or who habitually drift in and out. It probably means more to the British born miners who are sons of miners, even of the third and fourth generations, than to the son of Italian peasants whose traditions come from the farm. Readjustment may be more difficult for those miners in Illinois who own their own homes in isolated mining communities, than for the floating group in some of the West Virginia mines who are accustomed to being here today and gone tomorrow. Finding another job presents more difficulties to the miner in a mountain gully of West Virginia than to the miners in

³ Figures estimated from analysis of Census reports for 525,000 miners, U. S. Coal Commission, *The Bituminous Mine Workers and Their Homes*.

easy access of the industrial centers of Pittsburgh and St. Louis.

Probably it would not be desirable to make relative costs the sole basis for selecting the workers to be cast out. For the technical efficiency of the industry and the welfare of the workers who remain in it have claims which may run counter. It would scarcely be fair to the industry of the future to drain off all the workers best fitted for the new methods. Nor would it make for the welfare of labor in the new industry for those with most initiative to get out. For it will be the task of those who remain to maintain the rights of the workers during the protracted period of transition. This is no easy task; it calls for workers with more than average accomplishment in the arts of standing up for their own.

A satisfactory selection of workers would tax the intelligence of any group of persons. It calls for recognition of the various claims, often conflicting, of technical efficiency, of the permanent interest of the coal miners, and of a minimum of human costs in the transition. But in some way, selection has to be made. It may be made by conscious grappling with the problem and by formulating a program which makes such adjustment as it may between the different claims. Or it may come as the result of a number of independent decisions on smaller problems. Under the present form of control of the industry, it is in this second or planless way that the selection will be made.

The prospects of adequate recognition of conflicting claims under unselected selection is none too good. The corporation directors and managers who make the decisions which determine whether or not a particular mine shall operate are not in a position to know, or to consider if they knew, the effect of their decisions on the workers. The mine managers, responsible for selecting the workers to stay if the mine reduces its force, or to be taken on if the force is being increased, are not free to heed only the claims of efficiency. The custom of the industry, enforced in many fields by the United Mine Workers, often constrains them to lay men off in a prescribed order, which may have little relation either to the needs of the mine or those of the individual worker. The best that can be said for the present control of the industry is that it does not make inevitable a selection that is the most costly possible for the workers, or for the industry of the future. Those who stay, as well as those who go, will very likely be a run-of-mine sample, with some in each group who could be transferred to the other, with advantage to all concerned.

III. LABOR STANDARDS

The disorders which seem about to mark the course of the machine invasion hold other threats, less dramatic but no less serious. The coming of the machines endangers such labor standards as have been achieved. They threaten the workers with a

reduction in standards of safety, with longer hours, and with lower earnings. A strange threat, surely, when the machines themselves provide a means by which it should be possible to raise those very standards to new heights!

In simplest terms, labor standards are in danger because of the frenzy of competition which the coming of the machine lets loose. For when financial solvency depends on an ability to cut costs, harassed managers will seek ways and means not in one direction but in many. They will not confine their attention to the introduction of machine technique. Many indeed, bound by the ways of their fathers, will distrust the new fangled ideas, and will try to compete with machines by getting cheap labor. This will seem a reasonable course, since labor costs are the largest element in the total cost of mining. They may attempt to lower the wage rate, or to increase the hours worked for the same wage, or to modify the working rules which protect the miner's daily income and his chance to earn the prescribed rate. But whatever the point at which the attack is directed, its success means lower standards for the wage earner.

Nor will the attempt to lower wage standards be limited to those who are deaf to the message of the machines. The radical minority who adopt modern technique may be compelled to join in the attack on standards. At first this may not be true; if the minority is small enough the machines alone may

offer salvation. But as one firm after another avails itself of this opportunity some other method of cost cutting must be found. The revision of labor standards will undoubtedly suggest itself, all the more perhaps because many of the workers under the new technique will be classed as unskilled. It will doubtless seem to those who pay the wage bill that their wages should be brought into line with what is considered proper pay for the untrained.

The frenzied attempt to cut costs threatens safety standards as well as income and leisure. This does not mean that the directors of the mining corporations will deliberately reduce the safety precautions. Probably they will have no such intention. But their insistent demand for lower costs will have the same effect. Measures of doubtful value will be abandoned; the attention of those responsible for the operation of the mines will be centered too much on the balance sheet to leave time to inquire into cases of negligence here and there. The minor officials may feel that the company is not much interested in safety and will tolerate unsafe conditions if only the costs of mining come down.⁴

Such are the losses which impending confusion threatens in the field where the machines should promise gain. The workers' task of warding off these dangers and making the new technique serve their interests would be difficult, even if they were

⁴ See Hall, R. Dawson, Address of Chairman, Section on Mining of National Safety Council, *Proceedings* 13th Annual Congress, 1922.

organized into a single unit. Large groups of unemployed miners must weaken the bargaining position of any union. Bankruptcy just around the corner presents the coal corporations with arguments for lower wages, which a union finds difficult to answer. The pressure on individuals to find work at any wage is so great that the most solid union ranks could hardly be maintained intact. The miners however have not the advantage of organization extending over the whole industry. Their inability to act as a unit turns a difficult into a well nigh impossible task.⁵

IV. FREEDOM AND CONTROL

The peculiar freedom of the miner at his work must disappear with the introduction of machine technique. For this freedom is apparently a product of the disorganization of the industry and the geography of the working places. The far flung mining line has meant that the worker had little supervision and made most of the decisions about his own work. The disorganization of the whole mining process has enabled him to come and go almost at will, or to take a day off for hunting or fishing when the spirit moved him. To be sure his irregularity is sometimes irritating to a foreman trying to keep places in line. But nothing about the mine moves with precision.

The new technique changes all this. Concentrated workings make closer supervision both possible and

⁵ See below, Section VI, The Workers' Defenses.

inevitable. Machines must be tended in their own appointed fashion, not in the nine and sixty ways that seem right to nine and sixty miners. Individual initiative and judgment must give way before orders from above. Nor will the machines be as tolerant of irregularity as the foreman who was but recently a miner. One or two miners leaving early to go shopping or because "a man ought to know when he's tired," or going hunting on "rabbit day," may upset the whole elaborate mechanism under the new regime. For the essence of the new mining is working to a plan and on a schedule. Pillar drawing, haulage systems, mechanical loaders all call for a precision which cannot be attained if each worker is a law unto himself.⁶

The loss of individual independence at work is an inevitable price of a mechanized mining industry. Whether it be high or low, it must be paid if the new methods are chosen. That is not true, however, of the organized participation in the control of the mines which the miners have won for themselves in union areas. If individual freedom is to go, the work of the pit committee assumes even greater importance than it has in the past. For it becomes the one agency by which the worker exercises day to day control over his working life.

The possibilities afforded by this means of group control have hardly begun to be realized. For the

⁶ See Goodrich Carter, *The Miner's Freedom*, for development of this idea.

pit committee is primarily an instrument for the adjustment of grievances. Its duty is to protect the established rights of the miner, and to win for him new rights when circumstances are favorable. Much of its activity has been concerned with protecting the miner's individual freedom. But the effect on the management of the mines is not purely negative. The habit of meddling once started, is not easily kept within rigid boundaries. To be sure, by a magnanimous gesture the union agrees that "the management of the mine, the direction of the working force and the right to hire and discharge are vested exclusively in the operator, and the United Mine Workers of America shall not abridge these rights."⁷ But in the world of realities the pit committee constantly abridges these rights in innumerable ways. It concerns itself as a matter of course with the enforcement of safety laws, the assignment of working places, the measurement of dead work, the discharge of workers, the condition of the wash houses, the maintenance of the equal turn and kindred matters. It may go beyond this to making suggestions about the haulage system and it has been known to meddle with affairs touching the financial solvency of the mining corporation.⁸

Thus in many ways the committee has affected the

⁷ See for example, Official Mining Scale Agreement, Sub-district 5 of District 6, Ohio, Rule 1.

⁸ For a realistic description of the work of a pit committeeman see Wieck, Edward A., "A Coal Miner's Journal," *Atlantic Monthly*, July, 1924.

general efficiency of mine operation, now for good, now for ill. But these effects have been in the nature of by-products. The pit committee as a protective agency is well developed; as an active instrument for the elimination of waste and for the expression of the workers' interest in their work it is in its infancy.

The coming changes, however, threaten the control already acquired. The constantly shifting frontier of control moves backward and forward roughly in accordance with the bargaining power of the workers. Thus the competitive struggle which weakens the workers in their fight for wages, likewise weakens their ability to maintain or extend their participation in the management of the mines, even in union areas. A more serious danger, however, comes from the threat to the union fields. If they become of minor significance the number of miners who have any chance at control through their own committees is decreased.

V. THE PLIGHT OF THE UNIONIZED FIELDS

The danger to the unionized coal fields is a direct product of the over-expansion of the industry. Even at the present time, whole districts could be closed down without creating a coal shortage. With the impending increase in mine capacity all the unionized districts might be wiped out without banishing over-expansion from the mining industry. The immediate threat to the union fields, however, is not

total destruction but merely a shrinking market and a place of decreasing importance in the industry.

Reasons for such a threat are not far to seek. They are to be found in part, but only in part, in the fact that they are union fields, operating under agreement with the United Mine Workers. Because of their agreements, corporations are deprived of the opportunity to indulge in competitive wage cutting at an early date, when prizes are to be won by this means. Similarly they have not the same chance as their non-union competitors to introduce machines on the terms most favorable to the corporations. They may have to meet greater resistance to change on the part of the workers. All these are handicaps, and serious ones.

But there are reasons other than organization for the perilous position of the union fields. The coal in the great non-union fields of West Virginia and Kentucky is of rather better quality than that in the union fields, and a great deal of it can be mined with less expenditure of power and effort. Moreover, the mines on the whole are newer, less handicapped by mistakes of the past; the managers of the corporations contain more newcomers who do not know from experience that there is nothing to be learned about coal mining. Nor does the remoteness of these fields from markets deprive them of their advantages. The freight rate structure has been designed to enable coal from these fields to find a market, and their remoteness on the map is not

reflected in the charges they must pay. These advantages of the non-union fields are not new; but they are much more dangerous to the union districts than they have been in the past. To repeat a tale already told, the tyranny of overhead presses inexorably for increased output and the advantages of unspoiled seams beckon irresistibly to new ventures. The necessity for making the most of their opportunities was never so keen as it will be with the coming of the machines. At the same time, transportation facilities have grown more adequate and impose less check to future development than they did to past expansion.

To be sure it may be argued, as indeed it has been argued,⁹ that the very handicaps of the operators with union agreements will act as the push from behind which will drive them to salvation. For them, escape in all directions but one is cut off. Accordingly they must modernize or perish, and their choice will doubtless be modernization. But this argument overlooks tendencies in the industry, the employer's dilemma and the reacting consequences of modernization. It seems more probable that operators in union fields will spend some of their efforts beating against gates which will not yield or if opened permit no escape. In other words, attempts to secure "adjustments" of wages, and

⁹ See Lewis, John L., *The Miners' Fight for American Standards*, pp. 107-27.

new freight rates will doubtless for a time distract their attention from salvation by machines.

If the center of the industry shifts from union to non-union fields, the effects on the workers are serious. In the first place the burden of unemployment will fall most heavily on the union workers. In the second place the increased importance of the non-union fields means that their standards will extend over a larger portion of the industry, while the lesser place of the organized fields makes union standards less influential in determining non-union conditions. Thirdly, the majority of the workers will have no voice in the control of their industry, unless or until they create new machinery by which that control can be exercised. Finally, the living conditions of many will be worse than they are to-day. More of the workers' homes must be in the mountains of West Virginia and Kentucky, in company towns in which the workers must take what the corporation provides. The isolation of the mining communities will be more general than it is now, and the miners will be more cut off from their kind and more "different" than they have been in the past.

VI. THE WORKERS' DEFENSES

These are the costs with which the technical revolution in coal mining threatens the miners. But in face of these dangers, are the workers helpless? Must they submit? Are they but slaves? Or have

they defenses which can avert the threatened disasters?

The defenses of the workers are three, the market, the state, and their national organization. According to the presumptions of competition the market is enough, for the free play of competitive forces assures coal miners a lot no worse than that of their fellow workers. But in the impending crisis the market promises too little. It does its best work in protecting labor standards, for it does set some limits below which it would be impossible to cut wages. But these limits are vague and ill-defined, and they are lower than the miners have been accustomed to in good years. For they are the standards of the unorganized and of unskilled workers. More than that, in the great non-union fields whose importance threatens to increase, they are set by industries in non-industrial communities, accustomed to buying their labor on a market where alternative opportunities are few.

Slight as this protection is, it is greater than that afforded against other dangers. The market promises no insurance against unemployment, and no protection of the workers' rights to organized participation in the control of the industry. In spite of a large volume of fine phrases and some conspicuous gestures, recognition of the workers' interest even in workshop conditions has not spread far beyond the frontier of industries in which a strong trade union asserts the rights of the workers. The time may

come when workers' representation in the councils of industry is so general that it sets a standard for all industries. But that time is not yet.

The protection afforded by the state is also inadequate; for under the prevailing institutional system most of the dangers are beyond the reach of state action. Safety standards form the most conspicuous exception to the rule. But the precautions prescribed by law are below those enforced in the best mines today. Thus while state laws insure certain minimum standards of safety, they do not prevent reductions for large groups of miners. Moreover, if the new mining shifts to the non-union fields, the states in which it will be carried on are somewhat less strict in their requirements than the older mining states in which the union is well established.

The United Mine Workers at first glance appears a much stronger weapon than the state or the market. It is the defense against the blind operation of market forces upon which large numbers of the workers have relied for the last half century. Through it as an instrument the miners have secured even such standards as they now enjoy. Due to its efforts the miners of 1920 lived much fuller lives than the miners of 1890. But its past achievements are not an adequate basis for an estimate of what it may accomplish in face of the present danger. It is current strength and weakness that count in this crisis.

The power of the United Mine Workers has long been recognized by friend and by foe. In point of

numbers alone, it is one of the strongest trade unions in America, if not in the world. Its fighting qualities have often been proved, perhaps never more dramatically than in 1922 when it succeeded, in face of determined opposition by the mining corporations and a hostile government and public opinion, in holding the wage gains secured during war and post-war prosperity. It has entered into business relations with a large number of mining corporations and has established its right to be consulted about changes in conditions affecting the workers. The form of organization is likewise an advantage in the present crisis. For it is an industrial union, free from the danger of jurisdictional disputes between crafts which create internal dissension and distract attention from the big problems facing all the workers in the industry. The miners' favorable position can be appreciated by contrast with that of the workers in the building trades during the last 20 years, or of the steel workers with their craft organizations in the "nineties."

But for all this array of strength, the weakness of the union is no Achilles heel to be sought with care. On the contrary, it is so obvious that all who will may see. It comes primarily from the failure of the union to extend its sway over the entire industry. With more than a third of the workers ¹⁰ outside the union ranks, and almost half the tonnage produced

¹⁰ Based on membership given in United Mine Workers of America, Report of Secretary-Treasurer of Biennial Convention, 1924. It probably overestimates the present union membership.

by non-union mines, the power of the union is strictly limited. It cannot determine standards for the entire industry, nor can it push standards in the union fields very far above those prevailing in the non-union territory. An attempt to do so will result in corporations in the union fields losing business to rivals in the non-union areas. Probably this, more than anything else, accounts for the relatively slight increases in wages which the union secured for the workers prior to the war.

The danger from the non-union fields has been recognized by union leaders. From 1898 on, the problem of organizing these fields has received attention. Union energy and union funds have been expended in vain attempts to extend the organization over the entire industry.¹¹ Some progress was made, particularly in the war years when the Fuel Administration enforced an industrial truce. But the great non-union fields of the first of the century have remained non-union, and have increased in importance.

The existence of non-union territory has created a problem for the union in the past. Under the conditions that mark the course of the machine invasion, it constitutes a grave menace. For, as already noted, the coming frenzy of competition is likely to increase the tonnage from non-union areas at the expense of the unionized fields. This is a

¹¹ Suffern, A. E., *Conciliation and Arbitration in the Coal Industry of America*, 1915; Hinrichs, A. F., *The United Mine Workers of America and the Non-Union Coal Fields*, 1923.

three-fold threat to the union. It is a threat to reduce the number of workers in the fields now controlled by the union, a threat to reduce the area in which the union is recognized, and finally a threat to reduce its bargaining strength in the fields from which it cannot be ousted. For corporations in the union fields will be less able to withstand the competition of their non-union rivals. Consequently, they will be in a stronger bargaining position, and better able to resist the union demand for increases or to press for readjustments. But readjustments alone will not suffice. Those who are in the border territory, who feel most keenly the competition of corporations in non-union districts, will clamor for a free hand. The corporations that signed the union agreement this year may decline to sign next.

The hope for the union seems to lie in a rapid extension of its organization over the entire industry. What chance is there that it can do today what it has attempted and failed to do for a generation? Probably the union has never been in a worse position for an organization campaign. Idle miners in the organized fields have claims on the union funds which can scarcely be ignored. At best they can do little to maintain well filled coffers, without which the campaign could scarcely promise success. Short of a new miracle there seems little likelihood that the unorganized will become organized at a blast of the union trumpet.

Another serious weakness lies in the quality of

union leadership. Throughout its whole career, the miners' union has had to fight for existence. Its leaders consequently have been pre-eminent in the arts of extending the organization and of holding their own against hostile corporations. In other words, the abilities of the leaders are primarily skill in holding an unwieldy organization together, in maintaining or increasing its numerical strength and in using the tried and true methods of collective bargaining to win for the workers the ever popular "more now."

But in the crisis ahead, these methods will not suffice. New policies are called for, designed to meet new situations. The United Mine Workers can help little unless its leaders see clearly the problems of the industry and its workers, and develop extraordinary ingenuity in devising ways and means. Unfortunately, the available evidence indicates that at the present time they do not realize the plight of the industry and are not addressing themselves to the problem of devising means to avert disaster.

If the evidence of the printed page is to be believed, the international president is not unduly disturbed over the outlook for the miners, or for the union. Apparently he is still satisfied with the policy summed up in "no backward step."¹²

The official journal of the union brings evidence of the same kind. Its pages have little to say about

¹² See Lewis, John L., *The Miners' Fight for American Standards*.

the difficulties of the unemployed miner. Indeed they repeat the premises of all champions of competition. The way of the surplus miner will not be hard, for other industries call for his services.¹³ There is no indication that the leaders realize the implications of the coming of the machines. One looks in vain for any sign that the union is ready to assume new duties or responsibilities in order to cope with new conditions. Indeed a recent editorial expressly disavows any desire on the part of the miners to meddle with affairs beyond the tippie. The *Journal's* editor sees a solution of the dilemma for management in the adoption of "sane business policies and methods," namely a refusal to sell any coal which will not bring a profit. But this after all is not the affair of the miners. "They have no voice in fixing the price of coal, nor do they wish any such voice. All they do is to dig the coal."¹⁴

Perhaps the union leaders' inability to think in new terms, to conceive a constructive role for the union never came out more clearly than in the unfortunate controversy with the Brotherhood of Locomotive Engineers over the Coal River Colliers.¹⁵

¹³ "There is a demand for labor in other industries besides coal mining, and men who are unable to retain permanent employment in the mines can secure employment in other lines, provided, of course, they can get in contact with the opportunities in these other lines of work."—*United Mine Workers' Journal*, April 1, 1924, p. 7.

¹⁴ *United Mine Workers Journal*, April 1, 1925, p. 3. For repetition of the advice not to sell unless they can secure a profit see the *Journal* for July 1, 1925, p. 6.

¹⁵ This implies no judgment on the relative merits of the position of the two parties to the dispute.

To the Brotherhood's plea that they could not meet non-union competition if they paid the union wage scale, the president of the miners replied, "The United Mine Workers cannot be responsible for problems of management in which they have no voice. The question of efficient management to enable you to remain in the market with competing companies is one that must be dealt with by your corporation. It is a problem that forever confronts one who elects to become a coal operator."¹⁶

With leaders bound by the ideas of the past, with the weakness of the union enhanced by the very circumstances which demand almost super-union strength, the defense that the United Mine Workers can offer is none too strong. Of course, it may be argued that the possibilities of defense by trade union action are not bound up in the United Mine Workers. Let that union be destroyed; it would not be the first in the coal industry to fall by the wayside. A new union might be able to meet the needs of the workers where the United Mine Workers must fail.

Eventually, indeed, some such result might be attained. Certainly if the present union is to survive, it must be a very different organization from the one which is working today. But building a trade union is no easy task. There is no one so powerful that he can say "let it be done" and it is as good as done. Creating a new union or re-shaping the old

¹⁶ Letter of John L. Lewis to W. S. Stone, Aug. 27, 1924, published in the *United Mine Workers' Journal*, Sept. 15, 1924.

is a matter requiring years of patient effort. The workers' needs however are immediate; the opportunity to put some of the savings from waste into the pay envelopes must be seized before the savings find other pockets; dangers must be warded off when dangers threaten.

Moreover, conditions in the calculable future impose difficulties in the way of a new organization. On the one hand, the disordered conditions which make it hard for the United Mine Workers to extend its lines also impede the formation of a new union. On the other hand, the machines themselves work against rather than toward unionization, as many of the operators realize.¹⁷ A mechanized industry may be incompatible with trade unionism but a strong trade union in an industry ruled by the machine process has yet to make its appearance in this country. Moreover, the art of organizing the workers in such an industry is still to be mastered by the American labor movement.¹⁸ Whatever the distant future may hold, the nearer view discloses no probability of trade union defense if the United Mine Workers shall perish.

¹⁷ A typical statement is the following: "There are so many conditions, as for instance the large hold that union labor has on the mining industry, that if we can in any way free ourselves even partially from that burden by the introduction of mechanical loading, we will have done a great thing for the industry." From speech of Roberts, W. R., Chairman of Committee, Coal Mining Branch of the Standardization Division of the American Mining Congress, Fourth Standardization *Bulletin*, 1924, p. 27.

¹⁸ For fuller discussion of the problem of unionization in mechanized industries, see Editorial, by Goodrich, Carter (unsigned), in *New Republic*, January 30, 1924.

CHAPTER XI

THE PREVAILING DRIFT

But be so kind
To bear in mind,
We were the victims of circumstances.
—*Ruddigore.*

Recent events in the bituminous coal industry add a chapter to the long and tangled tale of compromised competition. Although statesmen have not been keen to interfere beyond what they regard as the rightful frontiers of the province of government, they have not been quite willing to leave the industry alone.

Indeed, in the years immediately following the war, so many people attempted to prescribe for coal that a confusing array of nostrums and guaranteed cures made their appearance. One and only one had the distinction of being taken. It was sponsored by the union and, at a later date, by an official of the federal government. It consisted in pegging wages in union fields at the level they had reached in the post-war prosperity, and then trusting competition to cure all ills. The union succeeded in getting it adopted for a year by the strike of 1922; the Secre-

tary of Commerce intervened to secure its continuance by the Jacksonville agreement of 1923.

The remedy has now been in effect for three years and the effects are beginning to be apparent. The Secretary of Commerce surveys the results, and is greatly pleased. "The saving of economic waste can be measured in hundreds of millions of dollars."¹ With his eye fixed on the price chart, he proceeds to count the gains to the consumer. But his optimism does not stop there.

On the basis of two facts, one of which is a recommendation that the mines standardize their practices and the other a decrease in the value of the coal supply in a year of depression in the trade, he draws a rosy picture of recent events in the coal industry. His analysis proceeds logically from the recommendation of standardization to its acceptance by the trade, and thence to practices of greater economy in the mining of coal, lower costs of production, lower prices to the consumer, a great saving to the nation, and the elimination of snow-birds and other unfit enterprises, and finally to its consummation in a tight and tidy industry, offering steady employment and ample returns to the laborer.²

¹ *Annual Report* of the Secretary of the U. S. Department of Commerce, 1924, p. 13.

² "The industry is now on the road to stabilization. The benefits lie not only in the provision of coal to the consumer at lower prices than have been attained at any time since the beginning of the war. The gradual elimination of high-cost and fly-by-night mines is bringing about a greater degree of concentration of labor upon a smaller number of mines, the increase in days of em-

The president of the miners is likewise pleased. "The over-development of the coal business . . . is on the way to elimination." "Exactly as was foreseen by the United Mine Workers, the law of supply and demand . . . is working a cure."³

According to the friends of the industry whose prescription was followed, the remedy has lived up to its promises. Some persons, however, may not be willing to take this appraisal on faith, but may ask for evidence. They may quite properly insist that they be shown first, that mine capacity is being decreased; and second, that it is the inefficient mines that are being abandoned. Then they may with equal propriety ask to see other symptoms of the patient. Has employment grown more regular in the last few years? Have the workers from mines that closed been absorbed in other industries? How have standards of work and safety fared? If it chances that the doubting Thomases believe in the value of trade unionism, they may push their inquiries further. Have the union fields held their ployment per annum, and thus a larger annual return to the workers. The inherent risks in the industry will be decreased because the efficient and stable operator will no longer be subjected to the type of competition that comes from those mines that exist only to take advantage of profiteering periods. No better example of co-operation to secure the elimination of national waste can be presented. The past year, as compared with the year 1920, shows a saving to the consumer of about \$1,000,000,000, which must be reflected in decreasing cost of production in every avenue of industry and commerce." *Annual Report of the Secretary of Commerce*, pp. 13-14. The release date is November 28, 1924.

³Lewis, John L., *The Miners' Fight for American Standards*, p. 38.

own since the strike of 1922? Has the union maintained or increased its strength, especially in the border territory? Has it maintained standards in fact as well as in name? Or, if the unbelievers are interested in rewarding merit with profits, they may ask if those righteous in technical matters have prospered.

Unfortunately, there is not available information that gives a clear cut answer to all these questions. Some can be answered quite definitely from current statistical reports. For others reliance must be placed on scattered suggestions, on common knowledge of those whose duties keep them in touch with the mines, and on inference from such factual data as are given. The results are not entirely satisfactory, but they show clearly enough that a cure is far from established.

There was a large reduction in the number of mines in operation in 1924. So much is not disputed, although figures are not yet available to make possible accurate comparisons with earlier years. But whether or not the capacity of the industry was decreased is uncertain. Certainly the drive for efficiency made more headway in 1924 than in 1923. The trade journals carry reports from one mine after another of marked progress in increasing output. But even in 1923, the average production per man, registered a 4 per cent increase over that of 1922. Thus it is reasonably certain that the effect of a reduction in the number of mines was at least par-

tially counteracted by an increase in the capacity of those that were left. Unfortunately, too, for those who identify a decrease in the number of mines with a reduction in capacity, there is nothing final in the closing of a mine. To be sure, it may be made so by the removal of all equipment even to the fans or the pumps. But there is little reason to believe that such drastic measures have been taken in most of the mines that were closed in 1924. Some of them have already been opened again in 1925, others may be in 1926, or even in 1927, to increase the plague of excess capacity.

It is even more difficult to determine the relative efficiency of the mines that have closed, and those that have remained in operation. The belief that it is the inefficient that have departed rests solely on *a priori* reasoning, as not a shred of evidence has been produced to support the belief. It is possible that the high cost operations are ⁴ the ones that have suffered. But with unequal wage scales, unequal capital charges, unequal freight rates, and, with mechanization, the dependence of costs on regularity of output, high costs and real inefficiency are far from synonymous. When the largest coal corporation in the country, employing some of the best engineers in the industry, closes all but two of its union mines, those who think that only the uneconomic mines are being eliminated may well reconsider.

⁴See Chapter VIII, "The Perils of Quantity Production."

Nor has the employment problem been solved in the last two years. In 1923, a year in which almost as much coal was mined as in 1920, the working time was only 179 days, compared with 220 days in 1920. Figures of employment for 1924 are not yet available, but the smaller production of coal gives some presumptive evidence that the days worked were fewer. There is some indication, however, that in 1924 the mines that worked at all worked more regularly ⁵ than before. In the sample of mines reporting weekly to the Geological Survey prior to October, 1924, a tendency toward the elimination of the mine working less than four days a week was to be observed. But later reports from a somewhat different sample show little evidence of such a tendency. The mine operating two or three days a week is still flourishing.⁶

No one knows how the workers employed in mines which closed down for the entire year have sustained life. Some may have shifted to other industries, but no evidence has been produced to show that many have found escape in this way. Those best acquainted with the habits of coal miners think that most of them have hung on, waiting for something to turn up, living on the income from a day's work now and then, on credit at local stores, on hard

⁵ See Tryon, F. G., McKenney, W. F., McKinney, R. M., "Shifts in Production of Bituminous Coal in 1924," *Coal Age*, Feb. 26, 1925, p. 329. But see Appendix A for discussion of limitations on data.

⁶ See *Monthly Labor Review*, May, 1925, pp. 125-6.

won savings, and on help from their more fortunate fellow workers.⁷

The effect of the competitive struggle of the last two years on labor standards is soon told. Throughout the great non-union fields wages have been reduced to the scale of 1919 or even of 1917.⁸ In terms of the rates prevailing in 1922 this means a reduction of from 30 to 50 per cent. It is possible that employment in West Virginia and Kentucky was more regular in 1924 than in 1922, but a 50 per cent improvement is unlikely. It would make the average days worked greater than they have been in any year since records were kept. Hours have changed less; the eight-hour day still prevails even in non-union fields; but the number of men working in mines operating 9 and 10 hours increased from 2.9 per cent of all employed in 1920, to 6.5 per cent in 1923.⁹

The lowering of safety standards has borne fruits too clear to be mistaken. The number of men killed increased from 1,679 in 1922 to 1,885 in 1924. Expressed in terms of exposure to accident, that is as a fatality rate per million man-hours worked, this means an increase from an index of 116 to 122 in the two years.¹⁰ The increase in deaths due to ex-

⁷ Based on statements of representative of U. S. Geological Survey and of some district officials of the United Mine Workers.

⁸ See Tryon, F. G., McKenney, W. F., McKinney, R. M., in *Coal Age*, Feb. 26, 1925, p. 329.

⁹ Figures furnished by U. S. Geological Survey. Figures for 1924 not yet compiled.

¹⁰ Average for 1911-1915, 100. Figures from Adams, W. W., *Coal Mine Fatalities in the United States, 1924*, U. S. Bureau of Mines.

plosions was even more marked; the index jumped from 120 in 1922 to 184 in 1924.¹¹ The acknowledged responsibility of management for conditions leading to explosions and the known methods of prevention make this figure especially significant.

Those interested in the fate of the union must be disturbed by the record of the shift in tonnage in 1924 to non-union fields. Production figures show that the total output declined in 1924, that the output of West Virginia and Kentucky was substantially greater than it was in 1920, while the states of the central competitive field produced much less than in the earlier year.¹² Later figures for 1925 repeat the tale, and give it added significance. For the first three months of 1925, the tonnage of Illinois, Indiana, and Ohio was less than for the corresponding months of 1924, while that of West Virginia, Kentucky, and Alabama was greater. In the next two months the output of the three union states was greater than for the corresponding period a year earlier, but not up to the record of 1923. In West Virginia and Kentucky, on the other hand, the production was greater than it was in either 1924 or 1923.¹³

An even greater shift to the non-union fields is to

¹¹ Ibid.

¹² Tryon, F. G., McKenney, W. F., and McKinney, R. M., "Shifts in Production of Bituminous Coal in 1924," *Coal Age*, Feb. 26, 1925, p. 329. See Appendix A of this book for figures.

¹³ Figures from U. S. Geological Survey, Weekly Reports on the Production of Coal. For detailed figures, see Appendix A of this book.

be expected in the winter of 1925-6, for the Interstate Commerce Commission has reduced the freight rate from the non-union fields of West Virginia to the New England markets. The avowed purpose of the order was to allow these bituminous coals to compete with anthracite.¹⁴ Pennsylvania producers, however, even those whose coal is mined by union miners, insist that their coal should likewise be given a chance at the anthracite markets by a lower freight rate.

The decrease in the strength of the United Mine Workers cannot be portrayed so graphically, but it is none the less real. The regions in West Virginia in which it had a foothold in 1922 have been lost completely, except for a single region in the north where a strike is now being waged in a desperate attempt to keep from being banished from the state. A strike in western Kentucky, begun a year ago, has never been settled, but advice from the field indicates that the union is almost destroyed in this district which it had held for 20 years. Oklahoma in the Southwest has been practically lost; mines in Pennsylvania have broken away.¹⁵ Even in its strongholds in the central competitive field the union shows signs of weakness that would have been almost incredible in 1923. In Ohio, it has had to yield to a demand for a "readjustment" of the scale

¹⁴ 101 I. C. C. 15006, dated July 25, 1925. The order required the establishment of joint rates by the several railroads involved.

¹⁵ Evidence from numerous issues of *Coal Age*.

for dead work. From Illinois and Indiana come reports of adventures in co-operative mining and other subterfuges to induce the miners to undercut the Jacksonville wage. To be sure, these are frowned upon by the international union, which has sought the aid of the courts in abolishing such nuisances. But the persistence of co-operative ventures and the necessity of external help to hold their men in line evidences that the power of the international has suffered a loss. But perhaps most disturbing of all is the report from Ohio that two mines have opened at the 1917 scale.¹⁶

But is there not a bright side to the picture? Are not these years, trying as they are, bringing appropriate rewards to the technically righteous? Are not the millions of dollars which have been saved to the consumers evidence of the elimination of many wasteful practices and of progress toward the ideal of economy? To the first question it is possible to bring forth no printed word to spoil the expected rhetorical answer. Profits and losses are still business secrets: no agency is yet sufficiently concerned to keep a record of bankruptcies in the industry. But almost every issue of the trade journals reports failures. And it is a matter of common knowledge that strong companies, whose dividends have been met for years, are in a precarious position, while the report goes that "nobody is making money in coal." Nor is this to be explained by general business con-

¹⁶ See *Coal Age*, May 1, 1925, p. 776.

ditions. On the whole 1924 was a good year for American business.

The meaning of the consumers savings is less subject to dispute. The fall in the price of coal has been far greater than the decrease in costs. Companies have cut prices in a desperate endeavor to gain trade, until it is common knowledge that the price of a large part of the coal sold has not covered the costs of its production. The trade papers as well as the journal of the union carry urgent advice to coal operators not to sell coal unless they can reap some profit. In short the lower price of coal is a gain to the consumer, which is sending corporation after corporation into the bankruptcy courts.

Thus all the available evidence indicates that the Jacksonville prescription is playing havoc with the coal industry, and especially with the welfare of the miners. It has closed mines, but has given no assurance that it will keep them closed, or that the ones it has temporarily removed from the industry are those that should be kept out. It has brought to the miners unemployment even while it has continued irregular work. It has not prevented reduced wages and longer hours in non-union fields, nor slackness in safety precautions in all districts, which has resulted in an increased toll of lives. It has resulted in a disturbing shift of tonnage from union to non-union fields, with the inevitable effects on the power of the United Mine Workers.

CHAPTER XII

THE GREAT CONFUSION

On this subject I pray you be dumb-
Dumb-dumb!
Your notions, though many,
Are not worth a penny,
The word for your guidance is "Mum-
Mum-mum!"

—*The Mikado.*

If the Man from Neptune, who just now is subbing for the overworked gentleman from Mars, has "ever been down a mine," the dusty annals of coal make no mention of it. The chances are against it; for even the most powerful telescopes reveal no bituminous upon his far-flung planet. When, presently, he wins the right to speak by taking his way underground, a pretty adventure in appraisal awaits him.

He will discover large and rich coal deposits, quite accessible, easy to work, able to give of their abundance. He will find ready for use a wonderful technique, called the machine-process, already well adapted to underground work, capable of turning nature's gifts into wealth with little waste and great efficiency. "Here," he will say, "is the source of a great industry, able to support in continued pros-

perity many mining operations, to command all needful equipment at a minimum cost, to grant to adults dependent upon it abundant means for the fulness of life and to the children ample opportunities for development, and all without imposing any undue burden upon the users of coal."

Then, in due course, it will appear to him that somehow promise and performance are not identical. He may by chance come upon a group of well-run mines, upon efficient and contented laborers, upon a regular supply of good coal. But he will, again and again, stumble upon mines irregularly operated, upon production which requires no forward planning, upon a conglomeration of growing enterprises which sprawls in its development. He will discover the industry taking from the nation's larder double the resources needed to do its work efficiently and supporting in semi-idleness more than twice the number of needed workers, and he will marvel at its attempt to play the double role of the prodigal son and the good Samaritan. Yet he will adulterate his wonder with no envy; for he will find laborers inadequately supported, operators forever fighting insolvency, and a nation of consumers taking their livings from a great industrial machine which may become useless through a stoppage of coal.

His hope is stirred when he comes upon a small group of insiders who in the ways of mining coal are radicals. He rejoices to find that in spite of their small numbers, these disciples of efficiency have a

secure foothold in the industry; he is sure they have the leaven for the lump of chaos. Their objective of two tons of coal for the cost of one appeals to his common sense. The instruments which they use, a permanent staff of engineers to plan and organize and a nicely assorted complement of ingenious machines, seem to him helpful enough. He is a trifle disturbed to find that the rules of the industry permit an operator to replace one art of mining by another whenever he pleases; but surely, he reassures himself, helpful devices must help.

Then, as he watches the impact of new methods upon an old industry, he will be startled to see in regular sequence a strange order of events. The machine process is introduced, the face is driven swiftly forward, the mining operations are concentrated, an increase of capacity appears, a mass of potential coal is created, an unwanted output is offered on the market, a plague of bankruptcy that respects not the fit ensues, the stuff of which mine workers make their lives is harder to get, and a disorderly industry journeys another stage towards chaos. "Surely," he must conclude, "in this topsy-turvy industry, the very tools of plenty promote fickleness and dearth, and efficiency is a curse."

Puzzled by these strange contrasts, he will begin to inquire into the nature of things. He has not fallen into the earthly habit, so general among those who cannot think in specific terms, of pattering about -isms. So, believing that strange things must

be the actions of strange men, he goes about among those who are concerned with the industry. There from a run-of-mine sample he finds the people in the industry—operators, technicians, mine workers, and consumers—much as other folk on earth. On the whole, their intentions are good, their habits orderly, their actions quite intelligible within the little situations which encompass them. The less resourceful among operators and technicians are living and acting in the ways which they have been told are rightful ways; the more resourceful are trying to better themselves by advanced methods which will reduce the expenses of production, after the most approved formulas of business and of engineering. The mine workers are buttressing their precarious livings about with the defenses of a militant unionism which experience has shown to be adapted to the end. In all, as men's actions go, the people in the industry are doing the best they can.

Next, in search of the source of confusion, the Man from Neptune will turn to the way in which the industry is organized. Since he is an unrelenting realist, and sternly refuses to consider anything but the case of bituminous coal, he will not listen to talk about free enterprise in general, competition in general, and how in general an industry is organized. In the industry he is surveying, he discovers behind the patchwork of collusion, outside control, and custom, a system based upon the idea that if each person does his bit properly, the industry will be con-

trolled and will yield all it has to offer. Then he observes a strange contrast between a notion that many sincerely hold that the individual is free to do as he pleases and a blind situation which renders his ignorant judgment of little account. He sees that many men, acting for themselves, ignorant of what others are doing, regardless of the larger affairs of the industry, get in each other's way and interpose barriers between good decisions and the expected results.

And yet the Man from Neptune finds the system roundly defended in spite of its performance. Sincere and honest men argue for a jumble of ill-advised judgments as the best way to maintain order. He even hears honest folk, many of whom have sought in one way or another to "interfere" with the organization, and all of whom have patches up their sleeves, dub the prevailing organization of the industry with such funny adjectives as "natural" and "automatic."

Eventually, he begins to inquire among the good folk how they intend to restore order. He can find no accredited spokesmen for the operators, for the mine workers, or for the consumers. At last he chances upon representatives of groups quarrelling over the meager returns which the industry yields and oblivious to the larger ones which waste claims as its own. They are, for all his own world, like dogs fighting over a bone when a feast is to be had for less exertion. He garners their opinions and adds

a generous sample from among the unorganized. Then he finds that he can stack their opinions, to right and left, in two piles.

The majority, on the right, believe the way toward order is to keep the old order. They tell him that the prevailing arrangements are all to the good, though they will do with a bit of tinkering. They would "turn the industry loose," and "leave it to competition." Men, whose principles would outwear any experience tell him that the economic laws of demand and supply are quite adequate to make the industry efficient and orderly.

The minority, on the left, is convinced that something ought to be done about it; but can hit upon no common plan. Some think consolidations would do the trick, others know that this is going too far and not far enough. Some demand a great cartel to unify the industry; others fear its power. Some want the industry nationalized, others will have none of it. The Man from Neptune proposes that a committee of wise Senators and learned Congressmen might set affairs straight, only to hear that their investigations have long been keeping printing presses going. And, then, since he is freshly arrived, in all innocence he suggests a fact-finding and program-proposing Coal Commission to point the way to order. But, for some reason which he cannot understand, they spurn this virgin suggestion.

And then for the first time it occurs to him that starting a coal industry anew is one thing, and get-

ting an old one in hand quite another. If a fresh start could be made, the problem of order and economy would be simple. Given a certain demand for coal and ample deposits, it is merely a problem of procedure to determine how the supply can be obtained with the least necessary cost to consumers and with fairness to all who are essential to its production. The coal question is nothing more than a choice of the best from among many good procedures. But, with a going industry, even if it is not going, the question has no such simplicity. A solution must make terms with an established system buttressed about with hoary traditions.

So the Man from Neptune seems to catch a vision of the great confusion in which the industry is caught. He sees a clash of vested interests in which operators, mine-workers, and consumers alike refuse to surrender current advantages for the greater promises of a nebulous afterwhile. He sees an array of vested rights compelling individuals to do as they will with their own even though their blind doings return to plague their authors. He sees the chance of action by all concerned with coal pent in by the laws of the land which make a unified direction of the industry impossible. He sees a bewildering ignorance of the larger situation and a confusing abundance of fearless and ill-informed advice. He sees an inertia which rejects the new for the reason that it is the new, and clings blindly to the old because it is the customary. And, permeating it all,

as the creator and the created of all the rest, he discovers the strange notions, the obsolete thoughts, the confused ideas which thwart vision, promote disorder, and hold a chaotic industry as in a vise. He wonders if it can be that vested chaos, like established order, creates in men's minds a defensive scheme of thought which makes its overthrow impossible.

Thus, confronted by the strange case of bituminous coal, he tries to reconcile visible facts with reasonable prospects. When a fling at coal mining is a gambler's desperate adventure; when coal operators in action undo each other's sound judgments; when bankruptcy is likely to visit the efficient as well as the inefficient; when the laborer's skill has lost its market and his job is likely to flit; when livings and standards of work and of safety are threatened by the lack of an agency to maintain them; when the kaleidoscopic pattern of the industry bears one design this month, and another the next; when no one knows even statistically what a day may bring forth; when the parties to the industry are so confused that they call upon the causes of the current plight to maintain order, he wonders where, oh where, the goodly promises of the competitive ideal to the coal industry have fled.

At this point the Man from Neptune will himself likely fall a prey to the great confusion. For that reason we may forgive him some strange words pencilled in a language unknown between the face

and the tippie. The rendering into the American language, about which experts will quarrel for decades, seems to be and yet cannot be this: "In a jumble of mines which the natives love to call the bituminous coal industry it is proper for each individual to do good that evil may come of it."

APPENDIX A.

A STATISTICAL SUMMARY

The statistics relating to coal mining are in almost as pretty a mess as the industry itself. To be sure, there is no dearth of figures; some people might think that there had been over-expansion in the gathering of data as well as in the mining of coal. One exasperated critic recently said: "We find ourselves in a sea of figures with no statistics in sight. The only figure to be found in all the mass of numerals connected with the bituminous coal industry that is clear cut and means what it says without equivocation or evasion is the number of tons of coal produced."¹

This statement is extreme, especially if coal statistics are compared with those for other industries. But it is not difficult to marshal evidence in its support. Coal prices are found to be "average values"; mine capacity turns out to be a hypothetical output, presumably achievable by regular operation; average number of workers dependent on the industry is found to lack precision. And so it goes. The production figures, however, remain unchallenged.

But a mass of inaccurate data should occasion no surprise. The records of the individual units which

¹Stewart, Ethelbert, "The Coal Situation in Illinois," *Monthly Labor Review*, May, 1925, p. 13.

compose the industry are too faulty to afford a basis for good statistics about the industry as a whole. Nor need the figures be thrown aside as worthless because they do not always mean what they say. True, the person who tries to use them as a basis for detailed plans for a re-organization of the industry can hardly escape disaster. But less exact information is required for diagnosing present ills. For this, they serve passing well.

The figures given below are the ones which have been found most useful in preparing this volume. Because of the dangers inherent in taking at face value data whose worth is somewhat depreciated, their limitations are set forth at some length. In some fields, the statistics that pass current are subject to so many qualifications that they confuse rather than clarify the subjects with which they deal. Figures on miners' earnings, costs of production, investments and profits are in this class. They are omitted in this statistical summary.

I. THE GROWTH OF THE BITUMINOUS COAL INDUSTRY

The table on pp. 260-261 gives the best figures available for measuring the growth of the bituminous coal industry in America. It will be noted that growth is measured in two ways, in terms of the number of workers, and in terms of annual output. To these might have been added the growth in terms of capital invested, but the reader of the text of this volume does not need to be told here that such figures are not obtainable.

The figures giving annual production are very satisfactory and may be accepted as a nearer approximation to accuracy than we often find in statistical data. They are compiled by the United States Geological Survey

from the reports of individual operators. The Survey has worked out a good technique for insuring completeness, and the original returns are subjected to a number of well devised checks. It should be noted, however, that reports are obtained by correspondence, not by enumeration. In all probability the figures are accurate only as far as millions of tons.

The figures purporting to give the numbers of workers are less accurate. They are likewise compiled by the U. S. Geological Survey from reports of individual operators, and are supposed to represent the "average" number of workers. But the Survey does not define what it means by the word or give any instructions for computing it. Accordingly each operator fills in the figure that seems to him best, or that the state of his records makes obtainable. Hence it is clear that no very precise meaning attaches to the figures called "average number of workers." Comparisons made with the schedules returned to the Coal Commission, however, have convinced the officials of the Survey that the results would be substantially the same if a mathematical average of each payroll was taken.

The assumption that this is the number of workers dependent upon the industry has been vigorously challenged.² It is pointed out that if a mine closes down and the workers transfer to another mine, they are counted not once but twice. If they repeat the performance they are counted a third time, and thus the reported number of workers would be in excess of the actual number. Those who are best acquainted with the

²See Stewart, Ethelbert, "The Coal Situation in Illinois," *Monthly Labor Review*, May, 1925.

practices of the mining industry, however, are not disturbed by this challenge. They point out that the time when one mine closes is usually a time when others also are closing, and still others are reducing their force. Therefore, the number of men who have an opportunity to be counted twice is not large enough to distort the figures seriously.

GROWTH OF THE BITUMINOUS COAL INDUSTRY 1830-1923 *

Year	Thousands of Workers	Annual Production in Thousands of Tons
1830	No record	105
1840	...	1,103
1850	...	2,880
1860	...	6,494
1870	...	17,371
1880	...	42,832
1890	192	111,302
1891	206	117,901
1892	213	126,857
1893	230	128,385
1894	245	118,820
1895	240	135,118
1896	244	137,640
1897	248	147,618
1898	256	166,594
1899	271	193,323
1900	304	212,316
1901	340	225,828
1902	370	260,217
1903	416	282,749
1904	438	278,660
1905	461	315,063
1906	478	342,875
1907	513	395,759

* Based on statistics U. S. Geological Survey.

GROWTH OF THE BITUMINOUS COAL INDUSTRY 1830-1923—*Continued*

Year	Thousands of Workers	Annual Production in Thousands of Tons
1908	516	332,574
1909	No record	379,744
1910	556	417,111
1911	550	405,907
1912	549	450,105
1913	572	478,435
1914	584	422,704
1915	557	442,624
1916	561	502,520
1917	603	551,791
1918	615	579,386
1919	622	465,860
1920	640	568,667
1921	664	415,922
1922	688	422,268
1923	703	564,157
1924	Record not available	483,280 ^a

^a Preliminary estimates subject to revision.

II. MINE CAPACITY AND OVER-EXPANSION.

There are a number of different meanings attached to the term "mine capacity," and consequently a number of ways of attempting to measure it. To some the term means the tonnage that the mines are equipped to turn out, if all their equipment were fully and efficiently utilized. There are no estimates extant of the total capacity figured on this basis.

Another meaning of mine capacity is the tonnage that could be produced by applying the best known methods to the present face area. Obviously it would be difficult, perhaps impossible, to get a very accurate estimate of capacity in this sense of the term. The rough calcula-

tions given in Chapter VIII of this book are, so far as is known, the only attempts at estimates of this kind.

A third meaning which has been given to the somewhat ambiguous phrase is the tonnage the mines would have produced if they had operated 308 days in the year and other things had remained the same. Defined in this way, capacity can be measured by a simple mathematical calculation, from data accumulated by the U. S. Geological Survey. The total output for a year is divided by the "average number of days worked"³ to get the daily output, and this figure in turn is multiplied by 308. The chief advantage of this figure is the ease with which it can be calculated. Its disadvantages are two, the shakiness of the assumption on which it rests, and the lack of correspondence between the thing it represents and the name by which it is called.

The assumption on which it is based is that if every mine and every worker were employed full time the daily output per worker would be the same as it is now. But there is some evidence that a mine working full time does not maintain the daily tonnage that it achieves under part time operation. It is known, too, that on the whole the better mines work more than the average. Hence the figures probably overstate the tonnage that would result merely from regular operation.

A more serious objection to the figures, however, is their name. Mine capacity is not likely to suggest this hypothetical output to the uninitiated; and the uncritical might not realize that the figure was far under the

³ See Section III of this appendix for meaning of this term. As it is based in part on the reported number of workers in the industry, it is none too accurate a figure for measuring the daily output.

maximum potential output. In the table on pp. 263-4 these currently accepted figures of "mine capacity" are given. They are useful in showing the over-expansion of the industry, even though they underestimate the physical capacity of the mines.

THE OVER-EXPANSION OF THE BITUMINOUS COAL INDUSTRY
1890-1923 *

Year	Production (Thousands of Tons)	Estimated Capacity (Thousands of Tons)	Excess Capacity	
			Thousands of Tons	Per Cent of Pro- duction
1890.....	111,302	153,030	41,728	37
1891.....	117,901	158,406	40,505	34
1892.....	126,857	174,477	47,620	38
1893.....	128,385	195,752	67,367	52
1894.....	118,820	216,695	97,875	82
1895.....	135,118	214,140	79,022	58
1896.....	137,640	220,246	82,606	60
1897.....	147,618	231,982	84,364	57
1898.....	166,594	242,725	76,131	46
1899.....	193,323	253,012	59,689	31
1900.....	212,316	279,317	67,001	32
1901.....	225,828	309,696	83,868	37
1902.....	260,217	347,341	87,124	33
1903.....	282,749	387,682	104,933	37
1904.....	278,660	426,478	147,818	53
1905.....	315,063	457,198	142,135	45
1906.....	342,875	493,671	150,796	44
1907.....	394,759	518,261	123,502	31
1908.....	332,574	533,723	201,149	60
1909.....	379,744	574,981	195,237	51
1910.....	417,111	590,965	173,854	42
1911.....	405,907	588,887	182,980	45
1912.....	450,105	604,774	154,669	34
1913.....	478,435	636,522	158,087	33
1914.....	422,704	672,083	249,379	59

* Figures for 1890 to 1921, from U. S. Coal Commission, Part I, *Relief from Irregular Operation and Over Development*. Figures for 1922 and 1923 calculated from data of U. S. Geological Survey.

THE OVER-EXPANSION OF THE BITUMINOUS COAL INDUSTRY
1890-1923—*Continued*

Year	Production (Thousands of Tons)	Estimated Capacity (Thousands of Tons)	Excess Capacity	
			Thousands of Tons	<i>Per Cent of Pro- duction</i>
1915.....	442,624	674,447	231,823	52
1916.....	502,520	673,450	170,930	34
1917.....	551,791	704,012	152,221	28
1918.....	579,386	718,736	139,350	24
1919.....	465,860	740,291	274,431	59
1920.....	568,667	796,494	227,827	40
1921.....	415,922	836,535	420,613	101
1922.....	422,268	915,900	493,632	117
1923.....	564,157	970,724	406,567	72

The causes of over-expansion cannot be shown by figures alone. The table on this page makes it clear, however, that improvements in technique have played their part.

EFFECT OF INCREASING EFFICIENCY ON MINE CAPACITY, 1890-1920
Estimated Mine Capacity, Actual Output, and Hypothetical Capacity if output per man per day had remained constant. For selected years, 1890-1920.

Year	Number of Workers	Estimated Capacity ^a (Thousands of Tons)	Actual Output (Thousands of Tons)	Capacity at Efficiency of 1890 (Thousands of Tons) ^b
1890.....	192,402	151,705	111,302	151,705
1895.....	239,962	214,334	135,118	189,205
1900.....	304,375	279,368	212,316	239,994
1905.....	460,629	459,671	315,063	363,197
1910.....	555,533	592,020	417,111	438,027
1915.....	557,456	671,333	442,624	439,543
1920.....	639,547	787,922	568,667	504,270

^a These figures were obtained by multiplying the output per man per day by 308 and multiplying the product by the number

III. IRREGULAR OPERATION OF BITUMINOUS MINES

The most familiar effect of the over-expansion of the industry is the irregular operating time of the mines. Fortunately we have a very good measurement of this irregularity in the statistics compiled by the U. S. Geological Survey. The figures most commonly cited to show the measure of irregularity are those given in the table on p. 266, the average number of days worked per year. For purposes of comparing one year with another, these are sufficiently accurate. Each mine is weighted by its average number of employees in computing the average, in order that any tendency of large mines to work more regularly than small may be reflected in the average. But if one wants to use the figure as a measure of the failure of the coal industry to attain the goal of regular operation, this figure paints the industry somewhat blacker than it is. Any mine that runs for any period in the year is counted in computing the average. Hence a mine that opens in November and operates 40 days counts just as much as the mine that has been pretending to run from January to January, and has achieved only 40 days operation. The results obtained in a small sample of mines by excluding mines that open up and those that close down during the year indicates that eight or ten days might be added to the annual average ⁴ if such mines

of workers. They differ slightly from those given in Table II which were obtained by getting the capacity for each state separately.

⁶ These figures were obtained by multiplying the number of workers for each year by the constant 788.5 (the output per man per day in 1890 multiplied by 308).

⁴ See U. S. Coal Commission, *Irregularity of Employment Attendance and Absentecism in the Coal Industry*, by H. B. Drury.

were excluded, or if some method was found to measure their actual in terms of their potential working time.

THE WORKING YEAR OF BITUMINOUS MINES, 1890-1923 *

Year	Average Days Worked	Year	Average Days Worked
1890.....	226	1907.....	234
1891.....	223	1908.....	193
1892.....	219	1909.....	209
1893.....	204	1910.....	217
1894.....	171	1911.....	211
1895.....	194	1912.....	223
1896.....	192	1913.....	232
1897.....	196	1914.....	195
1898.....	211	1915.....	203
1899.....	234	1916.....	230
1900.....	234	1917.....	243
1901.....	225	1918.....	249
1902.....	230	1919.....	195
1903.....	225	1920.....	220
1904.....	202	1921.....	149
1905.....	211	1922.....	142
1906.....	213	1923.....	179

* Based on statistics of U. S. Geological Survey.

Even a good average, however, tells little of irregularity as it affects the mine worker. In the table on p. 267 the variation in employment opportunity is shown by classifying the workers by the working time of the mines in which they were employed. A word of caution with regard to this table is necessary. It does not give accurately the opportunity for employment for the following reasons (a) some men, chiefly day men, work when the mine is not in operation; (b) the mine does not offer employment to the "average" number of men on every day the mine operates, and (c) some men, in

mines that show a very low record of days worked, may work in other mines and make their year less irregular than these figures indicate. The extent to which these make opportunity for employment vary from operating time, is not known.

VARIAION OF EMPLOYMENT OPPORTUNITY DURING SELECTED YEARS
DIFFERING IN BUSINESS ACTIVITY

Distribution of all Workers According to Operating Time of the
Mines

Operating Time of Mines (Less than Specified Days)	Percentage of Workers			
	1905	1914	1920	1921
20.....	0.3	0.3	0.1	2.9
40.....	1.1	1.7	0.3	7.0
60.....	2.4	4.3	0.6	11.2
80.....	4.2	6.7	1.3	16.6
100.....	5.9	8.7	2.1	24.0
120.....	8.6	11.7	4.1	32.3
140.....	12.0	17.1	9.1	44.7
160.....	17.1	24.8	16.0	56.1
180.....	23.4	34.3	25.6	66.4
200.....	33.4	46.4	34.2	76.0
220.....	51.3	60.5	46.9	84.3
240.....	63.7	75.8	56.7	89.4
260.....	77.1	86.0	69.7	93.7
280.....	87.1	93.2	79.8	96.2
300.....	93.3	98.0	93.5	98.7
320.....	100.0	100.0	100.0	100.0

IV. TECHNICAL PROGRESS

There are very few figures by which technical progress in bituminous mining can be measured. The statistics given below, showing the increase in the use of the cutting machine, the increase in use of mechanical power and the increased production per worker per day tell as much of the story as can be told from available statistical data.

The figures in the table on p. 269, giving the number of cutting machines in use and their output, are gathered by the U. S. Geological Survey, and may be accepted as substantially correct. The column giving the percentage figures shows very clearly the increasing extent to which the task of undercutting has been taken over by machines. But these figures of themselves tell nothing of the changes which have been made in the instrument called a cutting machine, or in other phases of the mining operation which make possible a better use of the machines. The figures in the last column in the table were added to throw what light they could on these changes.

A word is necessary as to the limitations of these last figures. They are not the average production per machine per machine-day, for unfortunately there are no reports of the time the machines are in operation, nor of the days worked by machine mines as distinct from pick mines.⁵ Accordingly the figures in the table on p. 269 were obtained by dividing the average production per machine per year by the average number of days worked by all mines. As machine mines probably operate somewhat more regularly than the average, the output for any given year is doubtless unduly high. But unless the differential has changed, the error should not invalidate comparisons from year to year.

The figures in the table on p. 270 measure technical progress by changes in the use of power per ton of coal produced, and by changes in the character of the power consumed. It should be noted that the first figures do

⁵ The Coal Commission analyzed returns for two years in this way.

INCREASING USE OF CUTTING MACHINES *

Year	Cutting Machines in Use	Machine Cut Tonnage		
		Amount in Thousand Tons	<i>Per Cent of Total Output</i>	Average Tons per Machine per Mine Day
1891.....	545	6,212	6	51
1896.....	1,446	16,425	12	59
1897.....	1,956	22,649	16	59
1898.....	2,622	32,413	20	59
1899.....	3,125	43,964	23	60
1900.....	3,907	52,785	25	58
1901.....	4,341	57,843	26	59
1902.....	5,418	69,612	27	56
1903.....	6,658	77,975	28	52
1904.....	7,663	78,607	29	51
1905.....	9,184	103,396	34	53
1906.....	10,212	118,848	35	55
1907.....	11,144	138,548	36	53
1908.....	11,569	123,183	38	55
1909.....	13,049	142,497	38	52
1910.....	13,254	174,012	42	60
1911.....	13,829	178,158	44	61
1912.....	15,298	210,539	47	62
1913.....	16,379	242,422	51	64
1914.....	16,507	218,399	52	68
1915.....	15,692	243,238	55	76
1916.....	16,198	283,691	56	76
1917.....	17,235	306,396	56	73
1918.....	18,463	323,931	56	70
1919.....	18,959	276,020	59	75
1920.....	19,103	339,813	60	81
1921.....	19,618	272,702	66	93
1922.....	20,436	267,032	63	92
1923.....	21,229	377,436	67	99

* Computed from statistics of U. S. Geological Survey.

not measure directly the substitution of mechanical power for human energy. In part, a greater use of power reflects increased distances from the face to the tippie; in part it reflects greater attention to ventilation and pumping, which means that work is now done by mechanical power that was hitherto left undone. On the whole, however, it measures an increased application of power to mining.

THE USE OF POWER IN BITUMINOUS MINING, 1869-1919 *

Year	Total Horse-power Used	Amount per 1000 Tons of Coal	Electric Power	
			Units of Horse Power	Per Cent of Total Power
1869.....	13,361	0.7	—	—
1879.....	26,191	0.6	—	—
1889.....	54,795	0.6	—	—
1902.....	493,148 *	1.9	68,094 *	13.8
1909.....	1,228,026	3.3	354,592	28.9
1919.....	2,155,412	4.7	1,478,472	68.6

* Compiled from the reports United States Census on Mines and Quarries.

* Figures as given in the report for 1909. That for 1902 gives them slightly higher.

The table on p. 272 gives the output per man per day, for what it is worth as a measure of technical progress. Clearly it is far from an accurate measure, as it is affected by a number of extraneous factors, the skill and morale of the workers as well as the natural conditions with which they contend. Conditions which are known to affect the output per man and to make the figure hard to interpret are listed by the U. S. Geological Survey, as follows:

As the coal that is most easily accessible is mined first, the difficulties of mining increase from year to year, especially in the anthracite region, where the mines are getting deeper, thinner beds are being mined, and more water must be pumped.

As the mines become larger, men must spend more time in going from the opening to the working face.

The increase in the value of the coal has encouraged its more complete extraction, which involves an increase in labor per ton raised.

The figures showing "men employed" probably include children. The number of children employed, although small, has been decreasing, a fact which influences the average.

The figures showing production represent only marketable coal. A generation ago it was not uncommon to ship the lumps only and leave the fines either underground or in dumps at the mine mouth. The productivity of the miner then would appear less than if he were credited with both fines and lump, as he is today. During the last 30 years there has been a marked improvement in the care given to the preparation of bituminous coal after it is mined, before shipment. This additional work has tended to increase the number of surface employees.

A small effect, but a growing one, arises from the inclusion in the average output per man of the product of steam-shovel pits, which have a much higher output per man employed than ordinary mines.

The average daily output is affected by changes in the working day. Such changes, however, have been relatively insignificant except at certain periods of readjustment, such as 1898 to 1903, and 1916 to 1919.⁶

It will be noted that most of these conditions tend to decrease the daily output. Hence the figures probably understate the effects of improving technique.

⁶ Tryon, F. G., and Hale, Sydney A., *Coal in 1922*, p. 505.

DAILY TONNAGE PER MAN EMPLOYED IN BITUMINOUS MINING,
1890-1922 *

Year	Output per Man per Day		Year	Output per Man per Day	
	Tonnage	Index Numbers		Tonnage	Index Numbers
1890.....	2.56	100.	1907.....	3.29	129.
1891.....	2.57	100.	1908.....	3.34	131.
1892.....	2.72	106.	1910.....	3.46	135.
1893.....	2.73	107.			
1894.....	2.84	111.	1911.....	3.50	137.
			1912.....	3.68	144.
1895.....	2.90	113.	1913.....	3.61	141.
1896.....	2.94	115.	1914.....	3.71	145.
1897.....	3.04	119.			
1898.....	3.09	121.	1915.....	3.91	153.
1899.....	3.05	119.	1916.....	3.90	152.
			1917.....	3.77	147.
1900.....	2.98	116.	1918.....	3.78	148.
1901.....	2.94	115.	1919.....	3.84	150.
1902.....	3.06	120.			
1903.....	3.02	118.	1920.....	4.00	156.
1904.....	3.15	123.	1921.....	4.20	164.
			1922.....	4.28	167.
1905.....	3.24	127.	1923.....	4.47	175.
1906.....	3.36	131.			

* Based on figures of U. S. Geological Survey.

V. COAL PRICES

Information about the prices for which coal is sold is none too adequate. There are quotations for "spot" coal which are given in some detail, and from which an index showing changes in spot prices is computed. But as not more than one-fourth of the coal is sold on the spot market, it is contract prices that count. These are not to be had, as open prices do not flourish in the coal industry. The best figures obtainable are those of

"average value" given by the U. S. Geological Survey. These are obtained by getting from each operator a report on the number of tons sold, the total receipts, the number of tons mined but not sold, that is, used at the mines or transferred to an affiliated corporation, and an estimate of the value of this unsold coal. Thus the figure for any given year is made up of spot prices, contract prices, and estimated values.

DISPARITY BETWEEN PRICE CHANGES AND INCREASING MINE CAPACITY, 1890-1923

Year	Average Value per Ton at Mine	Mine Capacity (Thousands of Tons)	Year	Average Value per Ton at Mine	Mine Capacity (Thousands of Tons)
1890.....	\$0.99	153,030	1907.....	1.14	518,261
1891.....	.99	158,406	1908.....	1.12	533,723
1892.....	.99	174,477	1909.....	1.07	574,981
1893.....	.96	195,752	1910.....	1.12	590,965
1894.....	.91	216,695	1911.....	1.11	588,887
1895.....	.86	214,140	1912.....	1.15	604,774
1896.....	.83	220,246	1913.....	1.18	636,522
1897.....	.81	231,982	1914.....	1.17	672,083
1898.....	.80	242,725	1915.....	1.13	674,447
1899.....	.87	253,012	1916.....	1.32	673,450
1900.....	1.04	279,317	1917.....	2.26	704,012
1901.....	1.05	309,696	1918.....	2.58	718,736
1902.....	1.12	347,341	1919.....	2.49	740,291
1903.....	1.24	387,682	1920.....	3.75	796,494
1904.....	1.10	426,478	1921.....	2.89	836,535
1905.....	1.06	457,198	1922.....	3.02	915,900
1906.....	1.11	493,671	1923.....	3.68	970,724

As an index of price changes, the figures have another limitation. The proportion of coal sold on the "spot" market varies from year to year. This change is regis-

tered in the figures of average value and therefore they exaggerate the changes in prices for coal sold on contract, and understate the changes in spot prices.

In order to show the lack of relation between changes in the value of coal and the rate of expansion, the figures of mine capacity given on pp. 263-4 are repeated here. The chart given in Chapter IV, p. 58 is the graphic presentation of these data.

VI. ESTIMATES OF EMPLOYMENT CAPACITY OF MECHANIZED COAL INDUSTRY

An estimate of the number of workers who could find employment in a mechanized coal industry is necessarily very rough. In the first place the new technique is not sufficiently developed for its labor requirements to be forecast with any precision. In the second place the relation to be maintained between labor required and labor used depends on the business organization. Experiments with improved technical methods have gone far enough, however, to make possible crude calculations of the number of workers they might need. In the following paragraphs three different estimates are worked out that are typical of a large number that might be worked from similar data. It is not to be thought that the figures are prophetic of the immediate future, or that they are adequate for forward planning in the coal industry. They are suggestive, however, and are given for that reason and no other.

It will be observed that the estimates given below assume that more men will not be called than the new technique demands. Doubtless this is over-sanguine. On the other hand, estimates of the machines' potential

production based on present performances are undoubtedly under-statements.

I. The Coal Commission showed that in a certain mine the output per man underground per day was doubled by the use of loading machines. Assuming that to be the general effect, we get the following estimate of the number of workers needed if all coal were loaded by machines.

Number of Inside Men, 1922.....	582,409
Number required if output doubled....	291,204
Outside men, 1922	105,549

Total, if inside men's output doubled.	396,753
--	---------

But mines in 1922 worked only 142 days. If you assume a working year of 300 days, the men needed would be reduced to 188,000. The output of coal in 1922 was only 422 million tons. If you allow for an increase of 30 per cent to bring the output up to 550 million tons, the men needed would be 244,000.

II. A recent article by Walter M. Dake in *Coal Mine Management*, May, 1925, gives an instance of a mine maintaining an average production of 750 tons per day with a working force of 60, inside and outside. Assuming that the country's coal requirement of 550 million tons could all come from mines doing that well, and that those mines worked 300 days a year, the estimate is as follows:

Output per man per day.....	12.5 tons	
Output per man per working year of 300 days	3750 tons	
Men required to produce 550 million tons.....		147,000

III. Mr. Gay of the Gay Coal and Coke Company reported in *Coal Age*, June 4, 1925, that at his mine two

men with one machine now did the work of 14 hand loaders. From the United States Census, we learn that "miners" formed 54 per cent of the total wage earners at bituminous mines. Assuming that only one-seventh of that number would be required with the new technique, the estimate is as follows:

"Miners" required with new technique ($\frac{1}{7}$ of 1922 figures)	43,000
Day men (1922 figures)	268,000
Total required with new technique to mine 422 million tons, working 142 days a year	311,000
working 300 days a year	147,000
Required to mine 550 million tons working 300 days a year	201,000

VII. THE CURRENT DRIFT

Recent events in the coal industry have not for the most part been recorded in statistical tables. Production figures, however, are available.

SHIFT OF PRODUCTION TO NON-UNION FIELDS, 1920-1924

(Output of the more Important Union and Non-Union States in 1924 Compared with Output in 1920)

State	Output in Thousand Tons		1924 Output as Percent- age of that of 1920
	1920	1924	
United States.....	568,667	483,280	85.0
Union:			
Illinois	88,725	67,880	76.5
Indiana	29,351	22,340	76.1
Ohio	45,878	29,200	63.6
Non-Union:			
West Virginia.....	89,971	110,000	122.3
Kentucky	35,691	45,000	126.1
Alabama	19,185	19,490	101.6

The figures on p. 276 and those in the table below are from the reports of the U. S. Geological Survey. The analysis of the 1924 data was published by F. G. Tryon and others in an article in *Coal Age*, for Feb. 26, 1925.

THE GROWING IMPORTANCE OF NON-UNION FIELDS

Percentage of Total Production from more Important Union and Non-Union States; 1920, 1924, and 4 Months, 1925

States	Percentage of Total Output of Country		
	1920	1924	4 Months 1925
Union:	28.9	24.6	24.2
Illinois	15.6	14.0	13.8
Indiana	5.2	4.6	4.6
Ohio	8.1	6.0	5.8
Non-Union:	25.0	36.1	36.1
West Virginia.....	15.8	22.8	22.8
Kentucky	6.3	9.3	9.3
Alabama	2.9	4.0	4.0

Records of the regularity of operation are hard to secure and difficult to interpret. Prior to April, 1925, the U. S. Geological Survey received weekly reports of operating time, which were analyzed monthly in the *Monthly Labor Review*. But the returns were incomplete, and, as reporting was entirely voluntary, the sample was, in all probability, a sample of the better mines. Moreover, after October, 1924, the number of mines reporting decreased steadily, making the returns incomparable from week to week. Since it was the mines with the poorer records that dropped out, the sample not only decreased in size but became less representa-

tive in character. The table below giving comparison of reports during the period when the sample remained substantially the same shows that the mines that worked five days a week or more and those that were idle all week formed a larger percentage of the total in 1924 than in 1922 or 1923. The number of mines working full time had increased somewhat, but the number not working at all had increased more.

CLASSIFICATION OF MINES BY WORKING TIME, SELECTED WEEKS, 1922, 1923, and 1924 *

Week Ending	Percentage of Mines					
	Idle all Week	Working				
		Less than 2 days	2 days, less than 3	3 days, less than 4	4 days, less than 5	5 days and over
Oct. 28, 1922...	4.2	34.8	25.0	13.7	9.2	13.1
Apr. 21, 1923...	18.6	26.6	22.8	13.2	8.5	10.3
Nov. 17, 1923...	32.0	12.7	15.1	14.4	11.1	14.8
Apr. 19, 1924...	46.7	11.4	13.2	11.1	8.0	9.6
Oct. 4, 1924...	40.9	3.7	6.2	9.0	12.8	27.4

* Based on weekly reports of the U. S. Geological Survey and adapted from Tryon, F. G., and others, "Shifts in Production of Bituminous Coal in 1924," *Coal Age*, Feb. 26, 1925. The designation of days worked is not the same here as that used in the article in *Coal Age*. There a mine working 16 hours and less than 24 was classed as working 3 days, because if it worked more than 16 hours, and worked an 8 hour shift, it broke into the third day. Such a classification makes the irregularity seem less than it is. In the table above the mine that worked 16 hours and less than 24 is called a mine that worked 2 days and less than 3. Thus the 3 day mines in the table in *Coal Age* appear here in the column in which 2 days is emphasized.

The meaning of this table is not so clear as it might be. In the first place, in these figures, a mine is a mine, whatever its size, and hence a classification of mines by operating time is a poor measure of regularity of

employment. In the second place, each week stands by itself, and there is no indication of the number of mines that alternated the idle weeks with fairly regular operation. In other words, the mines that operated full time for a week may have been far from achieving the goal of regular operation throughout the year. These limitations need to be kept in mind in reading the table on p. 278.

The figures after October 25, 1924, cannot be compared with the earlier figures, for the reasons already given. Nor can a new series be started here, for an examination of the returns shows that there was sufficient fluctuation in the number reporting to distort such a comparison. Selected weeks can be found in which the sample appears to have remained fairly constant. In the following table the reports for a few such weeks are presented. They show that the day of the part-time mine has not yet passed.

CLASSIFICATION OF MINES BY WORKING TIME, SELECTED WEEKS,
1924 AND 1925 *

Week Ended	Num- of Mines Re- port ing	Percentage of Mines					
		Idle all Week	Working				
			Less than 2 days	2 days but less than 3	3 days but less than 4	4 days but less than 5	5 days and over
Nov. 22, 1924.....	1905	30.2	3.2	5.8	10.7	15.0	35.3
Jan. 10, 1925.....	1907	28.2	2.1	3.4	7.8	11.2	47.4
Feb. 7, 1925.....	1906	27.7	4.1	6.8	12.3	14.1	35.1
Mar. 28, 1925.....	1890	40.6	8.9	12.0	14.3	8.5	15.6

* Based on reports of U. S. Geological Survey, analyzed in *Monthly Labor Review*.

APPENDIX B

THE ANNALS OF COAL

The annals of coal are voluminous enough to fill many a five-foot shelf. But in content they are none too rich, and he who wants to learn all about coal by ploughing through its chronicles is doomed to a dreary task. He will find the same facts or near-facts dressed up in many different garbs, until he grows weary of meeting old friends. A more serious matter is that, be he ever so diligent, he will find that many of his questions remain unanswered at the end of all his reading. For the works about coal are as varied in quality as coal itself. The diligent investigator will find himself now in a thick seam where he reaps rich rewards with little effort, and now in a thin seam where the labor is hard and the returns meager.

In the following pages are listed the more important sources of information about the several subjects of interest to the student of the coal industry. The list makes no claims to completeness; nor is a guarantee given of the quality of everything it contains. It has, however, been selected with some care in an attempt to bring together the best of available material.

I. GENERAL REFERENCES.

There is no single volume to which the reader in a hurry can be referred. The books listed below are

those which contain information on more than one aspect of the coal industry. In general the student will find at least background material in them, no matter what aspect of coal engages his attention.

Report of the U. S. Coal Commission, 1923. The four volumes which make up the report consist of a series of reports, on various phases of the mining industry. They contain a mass of factual material, honestly and painstakingly collected. The report as a whole constitutes the chief source of information about the coal industry of today. The serious student will find it indispensable.

The reports, however, are uneven. Some of them are extremely valuable; others, perhaps the majority, are inferior products. Their facts are uninterpreted or misinterpreted; they are badly presented; some are unintelligible, if not quite meaningless.

On the whole, although the report has many gaps in the facts it presents, its most serious weakness is that it fails in adequate analysis and interpretation of its own material.

U. S. Geological Survey, *Mineral Resources of the U. S., Part II, 1880-1922.* These reports give the best statistical data for the industry from year to year. They cover the more easily measured facts of the coal industry and those which can be obtained with least difficulty from the coal corporations. The figures are very carefully compiled, but the text comments need to be studied to see what they do and do not mean. On the whole the figures are limited to facts about the production of coal, the tonnage by states and counties, the number and size of mines, the working force, days worked, time lost on account of strikes, mining methods used, the value of the coal at the mouth of the mine, and the output per worker per year and per day.

U. S. Geological Survey, *Weekly Report on the Production of Bituminous Coal, Anthracite, and Beehive Coke*. This is issued on mimeographed sheets. It gives estimates of current production, and also includes many of the annual figures later incorporated in the annual report just described. Figures for 1923, for example, can now be obtained from the weekly reports while the volume for 1922 is still new. Prior to April, 1925, current reports of working time were given.

The Trade Periodicals: There are excellent periodicals serving the coal industry. No one who wants to keep abreast of current events and problems in the world of coal can afford to neglect the trade journals as a source of information. They are especially rich in discussion of the problems of technique, and some of them speak with great frankness of the backwardness of the industry. The more important journals include:

- a. *Coal Age* (weekly), founded 1911, New York. This is the best of the trade journals, especially on the technical aspects of mining. It is run for coal operators, but shows rather unusual independence in its editorial and news columns.
- b. *Coal Mine Management* (monthly), Chicago. This probably ranks second in quality, although it is still too new to be accurately placed. It has devoted a great deal of attention to problems of safety.
- c. *Coal Industry* (monthly), Pittsburgh, Pa., 1918-1924: incorporated 1924 into *Modern Mining*. This is second only to *Coal Age* for the period of its life under its own name.
- d. *Modern Mining* (monthly), Pittsburgh, Pa. This is also concerned with technical questions, but the general student will find it less valuable than the first papers on the list.

- e. *Coal Review* (weekly), Washington, D. C., 1917-1924. This was published by the National Coal Association. From it the student can learn little except the official attitude of the Association on current questions.
- f. *United Mine Workers Journal* (bi-monthly), Indianapolis, Ind. This is valuable chiefly for news of the Union. It states the official union attitude but has little news of the coal industry.
- g. *The Illinois Miner* (weekly).
- h. *The Mining Congress Journal* (monthly).

There are also good periodicals addressed primarily to the wholesale trade. Those listed below also contain some information about affairs between the face and the tippie, especially in the field of labor relations. For historical material they are very valuable.

- i. *Coal Trade Bulletin* (semi-monthly), founded 1898, Pittsburgh, Pa.
- j. *Coal Trade Journal* (weekly), founded 1869, New York.
- k. *Black Diamond* (weekly), founded 1886, Chicago.

U. S. Bureau of Census, *Census of Mines and Quarries* (biennial). Some statistics of the coal industry are included here that are not found in the reports of the Geological Survey. They include character of organization of individual enterprises, monthly variation in number of wage earners, number of salaried officials and technicians, land tenure and royalties, use of power. There are also figures on capital, operating expenses, etc., which can be used only by those to whom the printed word is not to be questioned.

U. S. Congress: A number of committees of House and Senate have held hearings on one or another aspect of

the coal industry. The reports of those committees, and more especially the minutes of evidence, contain a mass of information, some of it very valuable. Unfortunately there is a large amount of dead work needed to separate the coal from the slate. Congressional committees do not hew very closely to a given line and the title on the cover frequently gives little clue to the nature of the contents. The reports which have been found most useful in the preparation of this volume are listed under the several subjects for which they were used. A more extensive list is found in *The Annals of Social and Political Science*, January, 1924.

State Reports: The several states in which mining is carried on also issue reports by departments charged with greater or less surveillance of the mining industry. For facts about the industry in a given place some of these are very useful. The figures given are not in such form that one state can be compared with its neighbor, or that state may be added to state for a more general picture.

Secondary material of a general nature is not abundant. The best known works are:

Moore, Ellwood S., *Coal*, New York, 1922. This is almost a standard treatise and is reliable for the ground it covers. It is concerned with coal resources, the properties of coal, and the nature of the mining process, rather than with the economic aspects of the coal problem.

Hunt, E. E., ed., *What the Coal Commission Found*, Baltimore, 1925. This is a series of summaries of the separate studies of the Coal Commission, for those who have not time to read the complete reports. Others will find them useful as a guide to the more massive tomes of the government document.

Bruère, Robert W., *The Coming of Coal*, New York, 1922. This is an engaging and popular account of the meaning of coal in modern civilization, to those who use and those who mine it. Some attention is given to the shortcomings of the present organization of the industry, and a chapter is devoted to the effect of "super-power" on coal mining. The volume is too unpretentious to be more than suggestive.

Archbald, Hugh, *The Four Hour Day in Coal*, New York, 1922. Mr. Archbald has made one of the most significant contributions in recent years to our understanding of the coal problem. He treats primarily of the inefficiencies of underground management but relates these inefficiencies to the larger problem of the organization of the industry.

Gilbert, C. G., and Pogue, J. E., *America's Power Resources*, New York, 1921. The authors are concerned with the problem of the efficient utilization of a wasting resource. They challenge sharply the assumption that organization of industry around the profit motive will secure economic use of our power resources.

Shurick, A. T., *The Coal Industry*, Boston, 1924. The volume attempts to cover all that is known about coal mining, beginning with the coal fields and ending with "Economic and Sociological Conditions." It is dedicated to the coal industry and the dedication sets the tone for the book. Most of the factual data it contains are easily available elsewhere, and the serious student will do well to follow them to their sources. A number of inaccurate statements have crept into this volume.

II. THE TECHNICAL ASPECTS OF COAL MINING.

A guide to the literature on technique for the technicians lies beyond the competence of the authors of this

volume. All they are attempting is to give the lay student some clue to enable him to find some non-technical descriptions of the mining process and some discussion of the impending changes in technique.

In the following works of a more general character short descriptions of the older art of mining are to be found:

Moore, Ellwood S., *Coal* (see above).

Shurick, A. T., *The Coal Industry* (see above).

Lubin, Isador, *Miners' Wages and the Cost of Coal* (Investigations in Industry and Labor, Institute of Economics, Washington), 1924.

Jevons, H. Stanley, *The British Coal Trade*, London, 1915. This description applies to English mines and is accurate only in its broad outlines for American mining. It should be read in connection with some of the American works already cited.

For a history of the development of the prevailing technique, especially in the earlier stages, one must go to English sources, as it was in Great Britain that the technique was worked out. Among a large number of books to which reference might be made, the two following stand out:

Dunn, Matthias, *A Treatise on the Winning and Working of Collieries*, 1852.

Galloway, Robert L., *A History of Coal Mining in Great Britain*, London, 1882.

For recent improvements in technique, the student should consult:

Mining Catalog: Issued annually at Pittsburgh, by the Keystone Publishing Company. See especially the

articles by Zern, E. N. Although the catalog is put out primarily to increase the use of machinery and is supported largely by advertisements of machinery, the editor is a mining engineer of high standing. Statements about the development of technical methods may be accepted with entire confidence.

Statements about the backwardness of the art of mining are to be found scattered here and there in the columns of *Coal Age*, *Coal Mine Management*, and *Coal Industry*. More detailed appraisals are given in:

Mason, Arthur J., "Comments of an Ore Engineer," *American Economic Review*, Vol. XI, No. 1, Supplement.

U. S. Coal Commission, Part III, *Report on Underground Management*, prepared by Sanford E. Thompson and Howard N. Eavenson.

Polakov, Walter N., "Coal; A Mismanaged Industry," *Dial*, Nov. 1, 1919.

For discussion of impending changes and the problems connected therewith, the best sources include:

The trade journals (see above). Attention should be called especially to the *Coal Age* annual summary of progress. This appears early in January of each year as one of the regular issues of the magazine.

The Standardization *Bulletin* of the American Mining Congress.

Transactions of American Institute of Mining and Metallurgical Engineers.

U. S. Coal Commission, *Report on Underground Management* (see above).

For the principles underlying the newer and the newest technique, the student should consult the general literature on technology and quantity production.

III. BUSINESS ASPECTS OF MINING

Very little about mining as business enterprise has found its way on to the printed page. This little is fragmentary and turns up in unexpected places. A United States senator perhaps, sitting on a committee to inquire into the causes of a strike in West Virginia, shows a certain curiosity about how the coal corporations conduct their business. The result is a few paragraphs in the printed report, enough to be suggestive, but usually not enough to do much to make the dark places light. The more important documents in which such paragraphs have been found are listed under the heading "The Plight of the Consumer" (below). A few of the larger coal corporations publish annual reports, which give as much about the business activities of the mining enterprise as annual reports usually give. The trade journals carry frequent notices of failures, re-organizations, expansions, sales of property, and what not, but no attempt is made to bring these together in a systematic way. Analyses of income tax returns show some things about the profitableness of the venture for taxation purposes. More systematic attempts to study certain aspects of the business of mining were those made by the Federal Trade Commission, the U. S. Fuel Administration, and the U. S. Coal Commission. The results appear in the volumes listed below.

U. S. Federal Trade Commission, *Cost Reports—Coal*.

1. Pennsylvania, Bituminous, June 30, 1919.
2. Illinois, Bituminous, June 30, 1919.
3. Alabama, Tennessee, and Kentucky, Bituminous, June 30, 1919.

4. Ohio, Indiana, and Michigan, Bituminous, June 30, 1919.
5. Maryland, West Virginia, and Virginia, Bituminous, June 30, 1919.
6. Trans-Mississippi States, Bituminous, June 30, 1919.

Careful study of the text of these reports yields a good deal of information about the business methods of coal corporations, especially their accounting methods, even while it serves to cast some doubt on the value of the results presented in the body of the report.

U. S. Coal Commission, Part IV, *Cost of Production of Bituminous Coal*, by David L. Wing and James E. Black. This follows along the lines of the cost reports of the Federal Trade Commission, and throws little new light on the subject. The figures are obviously of more recent date.

Garnsey, Cyrus, Jr., Noons, R. V., and Allport, J. H., *Methods of Fixing Prices of Bituminous Coal*, U. S. Fuel Administration, 1918.

Chance, H. M., "Valuation of Coal Land," *Transactions of the American Institute of Mining Engineers*, Vol. XLVI, p. 1315.

U. S. Federal Trade Commission, *Investment and Profit in Soft Coal Mining*, 1916-21, Washington, 1922.

U. S. Coal Commission, Part IV, *Investment and Profits of Bituminous Coal Operators*, by David L. Wing and James E. Black.

These last two reports make it clear that the terms "investment" and "profit" have so many meanings that they really have no meaning for the coal industry. The reports are in general similar in scope and method. The Coal Commission report contains an analysis of unaudited income tax returns that is not found in the other report.

U. S. Bituminous Coal Commission, 1920. This report contains an analysis of income tax returns for 1918 compiled by the Treasury Department.

IV. THE LIFE OF THE WORKER

The life of the worker in the coal mines has come in for its fair share of discussion and investigation. In fact, there is probably a larger body of material for the non-technical student on this subject than on any other connected with the mining industry. Strikes have called attention to the claims of the workers; disturbances of the public peace which followed in their train have caused congressional committees and local government agencies to make inquiries into the "causes" of such disturbances; groups concerned with studying the welfare of industrial workers have not neglected the coal miners. Most of the studies give only partial pictures, many of the statements are mere assertions, some of them obviously generalizations based on very limited observations, and much of the material bears on its face the evidence of partisanship. None the less material from which to build up a picture of the life of the workers is relatively easy to obtain.

1. *Safety and Health.*

U. S. Bureau of Mines, *Coal Mine Accidents Series*. These are issued annually and give the best figures obtainable on the number of fatal accidents, the rate per 1000 three hundred day workers, and per million tons mined.

U. S. Bureau of Mines, *Special Bulletins* dealing with particular phases of the safety problem.

U. S. Coal Commission, Part III, *Safety in Bituminous Coal Mining*, by E. A. Holbrook and others.

This analyzes the figures of the Bureau of Mines somewhat further, brings together fatality rates for European countries, and discusses the adequacy of existing safety laws and their enforcement.

American Labor Legislation Review, occasional articles.

There is no comprehensive study of the health of mine workers. The report of the Coal-Commission cited above analyzes some of the available data. Other discussions of miners' health are found in:

Frankel, Leo K., and Dublin, Louis I., *Sickness among Coal Miners and their Families*, New York, 1917.

Hayhurst, Emery R., "Health of Illinois Coal Miners," *Report of Illinois Health Insurance Commission*, Springfield, 1919.

Hayhurst, Emery R., "Health of Ohio Coal Miners," *Report of Ohio Health and Old Age Insurance Commission*, 1919.

Harrington, D., "Is Coal Industry Blind to Health Hazards of the Mine?" *Coal Age*, Nov. 27, 1924.

2. *Earnings and Wages.*

Stray bits about wages and earnings can be picked up in almost any hearing of a congressional committee to inquire into any phase of coal mining. More systematic studies include:

Lubin, Isador, *Miners' Wages and the Cost of Coal* (Investigations in Industry and Labor, Institute of Economics), 1924. This deals primarily with the methods of rate fixing in union fields and the effect of the existing wage structure on the industry and on equity between workers.

U. S. Coal Commission, Part III, *Report on Wage Rates in the Bituminous Coal Industry*, by W. E. Fisher. This is a technical study of wage rates, in non-union and union fields. Much of the material is also found in Lubin, I., *Miners' Wages*. The actual rates in non-union fields are not to be found elsewhere. Little attempt is made to interpret the data presented.

U. S. Coal Commission, Part III, *Report on Earnings of Bituminous Coal Mine Workers*, by Anne Bezanson. This is altogether the most elaborate and most complete study of miners' earnings extant. Unfortunately, however, the data are neither well analyzed nor well presented. That portion of the text which describes the methods used needs to be studied with great care before the student is in any position to draw conclusions from the figures given. In general he will find the cruder data as given in the tables in the appendix of more value than those in the text tables.

It is still true that one cannot speak with confidence about the amounts miners earn.

Drury, Horace B., "Wages in the Coal Industry as Compared with Wages in Other Industries," *Annals of the American Academy of Political and Social Science*, January, 1924, page 314. This is a very careful analysis of the figures in the report of the Coal Commission cited above. Mr. Drury's familiarity with the schedules from which the figures of earnings were obtained made it possible for him to make corrections and apply methods of analysis that the outsider would be unable to use.

U. S. Bituminous Coal Commission, 1920, *Majority and Minority Reports*, Washington, 1920.

U. S. Congress, House of Representatives, *Investigations of Wages and Working Conditions in the Coal Mining Industry*, Hearings on H. R. 11022, Committee on Labor, 67th Congress, 2nd session, 1922.

U. S. Congress, House of Representatives, *Investigations of Wages and Living Conditions in Coal Mining*, Hearings on H. R. 354, Committee on Labor, 64th Congress, 2nd session, 1917.

U. S. Bureau of Labor Statistics, *Hours and Earnings in Anthracite and Bituminous Coal Mining*:

Bulletin 279, Washington, 1921.

Bulletin 316, Washington, 1922.

These bulletins give hours and earnings of a small sample of bituminous miners, for single payroll periods.

3. *Living and Working Conditions.*

Goodrich, Carter, *The Miners' Freedom*. This is a study of the working life of the miner, and the effect of the introduction of new technique on that life. It deals especially with the "intangibles," such as freedom, independence, discipline, and the like.

U. S. Coal Commission, Part III, *Report on The Bituminous Mine Workers and their Homes*, by Marie Obenauer and Bertha Nienburg. This is the only attempt to study living conditions in enough communities to give a picture of the entire industry. The center of interest here is the company town, but some attention is paid to the independent communities in union fields. An interesting feature is the attempt to grade communities on the basis of accepted (conventional and scientific) standards of health and decency.

U. S. Women's Bureau, *Home Environment and Employment Opportunities of Women in Coal Mine Workers' Families*, Bulletin No. 45. An analysis of some of the material from reports obtained by the Coal Commission.

U. S. Immigration Commission, *Report*, Vols. 6 and 7, 1911. Changes have come to the mining communities since 1910 no doubt, but the descriptions found in these

volumes read much like those found in the report of the Coal Commission of 1923. This is true of descriptions only: the figures on wages and earnings have only historical interest.

Bituminous Operators Special Committee, *Living Conditions in the Bituminous Coal Field*, Brief submitted to the U. S. Coal Commission, 1923. This was designed to show that the mining villages, especially the company towns, are not so black as they are frequently painted. None the less the picture presented is drab enough.

There are also a large number of studies of individual mining communities and groups of communities. Among the more important of recent date are:

U. S. Children's Bureau, *The Welfare of Children in Bituminous Coal Mining Communities in West Virginia*, Washington, 1923.

U. S. Bureau of Education, *Schools in the Bituminous Coal Regions of the Appalachian Mountains*, Washington, 1920.

4. *Employment.*

Numbers of articles, pamphlets, and books have been written about the irregular employment of the bituminous miner. The most complete and careful analysis of the extent of this irregularity is found in:

U. S. Coal Commission, Part III, *Irregularity of Employment, Attendance and Absenteeism in the Coal Industry*, by Drury, H. B.

U. S. Coal Commission, Part I. *Relief from Irregular Operation and Over-development*, by Lesher, C. E.

For later information and data about the current state of the industry, consult:

U. S. Geological Survey, *Coal in 1922*, and *Weekly Reports*.

U. S. Bureau of Labor Statistics, *Monthly Labor Review*.

5. "Masters" v. "Servants."

A long line of documents deal with the master-servant relationship in coal mining and make their contribution to the sum of knowledge in this sphere. In the first place, there are partisan statements issued by the representatives of both sides at times of dispute. These are valuable for the light they shed on the temper of the spokesmen of the two sides, but should not be taken too seriously even there. They reflect an attitude for publication which is frequently somewhat different from the attitude which determines action. Secondly, there are reports of congressional committee hearings to investigate labor conditions at the time of particular strikes. These contain many statements of the kind already described but they also contain many less guarded statements which sometimes present a truer picture of things as they are. On the whole they are rich in colorful material and dramatic incidents, but show the two groups in the industry at war rather than at peace. Finally there are a number of secondary studies, some of them dealing with special phases of industrial relations and some attempting to give a general account. No one volume, however, gives anything like an adequate picture of the situation.

Suffern, Arthur E., *Conciliation and Arbitration in the Coal Industry of America*, Boston, 1915.

This book deals with the formal relations between miners and operators, the history of joint relations, the

machinery for settling disputes, the beginnings of an industrial code in the industry.

U. S. Coal Commission, Part III, *Report on Labor Relations in the Bituminous Coal Industry*, by J. H. Willits and others. This is a study of the day-to-day relations between managers and miners, with little attention to the larger questions of the environment in which those relations are set.

U. S. Coal Commission, Part I, *Report on Civil Liberties in the Coal Fields*. "An attempt to answer the inquiry of Congress with reference to the 'causes which from time to time induce strikes.'"

The report was written by an eminent lawyer serving on the Commission. It is saturated with legalistic notions, and attempts to arrive at an impartial statement by balancing claims of operators against claims of the union. Thus it misses most of the essentials in the long drawn-out dispute over civil liberties. It devotes some pages to a discussion of Herrin, and notes that "the soil of the county is largely of a light red clay."

Hinrichs, A. F., *The United Mine Workers of America, and the Non-Union Coal Fields*, New York, 1923.

Tryon, F. G., "The Effect of Competitive Conditions on Labor Relations in Coal Mining," *Annals of the American Academy of Political and Social Science*, January, 1924. This paper sets forth very clearly some of the larger economic factors frequently ignored in discussions of strikes and their causes.

Chafee, Zechariah, *Coal and Civil Liberties*, a report to the U. S. Coal Commission by the Committee on Coal and Civil Liberties; typewritten, presented August, 1923. A copy of this report is available in the files of the Commission and in the library of the U. S. Department of Labor, Washington.

U. S. Congress, Senate, *West Virginia Coal Fields*, Hearings on S. Res. 80, Committee on Education and Labor, 67th Congress, 1st session, 1921.

State of West Virginia, *Mining Investigation Commission*, 1912.

Lane, Winthrop D., *Civil War in West Virginia*, New York, 1921.

Blankenhorn, Heber, *The Strike for Union*, New York, 1923.

Lewis, John T., *The Miners' Fight for American Standards*, 1925. A justification and explanation of the official position of the United Mine Workers since 1922. For the ills of the industry, the law of supply and demand will work a cure.

Selekman, B. M., and Van Kleek, Mary, *Employees' Representation in Coal Mines*. A study of the Rockefeller plan of employee-representation in the Colorado Fuel and Iron Company. The plan is appraised in terms of the objectives of its originators. Comparisons with conditions in union mines are sedulously avoided, with the result that the reader who is not in position to make his own comparisons is not given all the materials for judgment.

Emmet, Boris, "Labor Relations in the Fairmont, W. Va., Bituminous Coal Field," U. S. Bureau of Labor Statistics *Bulletin* 361, 1924. This is based on a study made for the Coal Commission. It contains an account of one of the few schemes of employee-representation in the non-union portion of the industry.

Partisan statements giving the Mine Workers official attitudes are found in the files of the *United Mine Workers' Journal*, and in occasional pamphlets or statements to the press.

The position of the mining corporations is set forth

at some length in a series of *Briefs* presented to the U. S. Coal Commission. In reading, one soon becomes aware that they were drawn up by a well-known firm of attorneys, and reflect attitudes of lawyers quite as much as attitudes of coal mine operators.

A better picture of the position of the two groups in union coal fields is given in:

Proceedings: Interstate Joint Conferences of Coal Miners and Operators, 1898-1923.

The student who wishes to pursue further the study of the great confusion of industrial relations in the coal industry will find a useful bibliography in Lubin, I., *Miners' Wages*.

V. THE PLIGHT OF THE CONSUMER

Attempts to learn how well the consumer is served by the coal industry, year-in, year-out, are not numerous. Most of the discussion of his plight occurs in emergencies, and there is a marked tendency to measure the delinquencies of the coal industry solely in terms of its departure from conditions to which the coal consumer has become accustomed. The few attempts at appraisal in terms of the "fairness" of the prices of coal have come to grief because they have failed to get a reasonably accurate measure of costs of production, profits, and like financial items, upon which judgment must rest. The studies of costs, margins and profits are listed above under the heading "Business Aspects of Coal Mining."

The plight of the consumer during emergencies can be found described in some fulness in various Senate hearings, especially the following:

U. S. Congress, Senate, *Increased Price of Coal*, Hearings before Sub-Committee of the Committee on Interstate Commerce, on S. Res. 126, 66th Congress, 1st session, 1919.

U. S. Congress, Senate, *Reconstruction and Production*, Hearings before a Select Committee on Reconstruction and Production, on S. Res. 250, 66th Congress, 3rd session, 1921.

U. S. Congress, Senate, *Shortage of Coal*, Hearings before a sub-committee of the Committee on Manufactures, on S. Res. 163, 63rd Congress, 2nd session, 1919.

U. S. Congress, Senate, *Publication of Production and Profits in Coal*, Hearings before Committee on Manufactures, on S. Res. 4828, 66th Congress, 1st session, 1921.

The student who wants to follow the course of prices in the coal industry will have some difficulties. The list below gives the best available sources:

U. S. Geological Survey, *Mineral Resources of the U. S.* Part II. This gives the average sales realization at the mouth of the mine for each year.

Leshner, C. E., *Prices of Coal and Coke*, U. S. War Industries Board, Price Bulletin 33, Washington, 1919.

Coal Age, publishes a weekly index of spot prices. These apply only to the relatively small portion of coal which is sold without previous agreement. They commonly run somewhat higher than the prices for coal sold on contract.

U. S. Bureau of Census, *Census of Manufactures* (biennial). This gives the cost of fuel and power for different industries. It is the only available evidence of the importance of fuel costs in the expense budget of different industries.

Inter-State Commerce Commission, *Statistics of Railways* (published annually). These show the cost of fuel to the railroads.

A valuable discussion of the methods of buying coal and the possibilities of storage is found in American Engineering Council, *Industrial Coal Purchase, Delivery, and Storage, 1924*.

No attempt has been made to measure the increase in costs due to backward technique and inefficient underground management. An interesting study was made of the increase in costs due to irregular operation of the mines.

U. S. Coal Commission, Part III. Report on Effect of Irregular Operation on Unit Cost of Production.

For the consideration that is given or is not given to the claims of future generations of consumers, the student should consult:

U. S. Coal Commission, Part III, *Amount and Nature of Losses in Bituminous Coal Mining in Eastern United States*, by G. S. Rice and J. W. Paul.

Ashley, G. H., "A Glance into the Future," *New York Electrical World*, Nov. 15 and 22, 1919. A good brief statement of the exhaustion of the coal reserves.

VI. THE ENGLISH COAL PROBLEM

Some students may be found who are not content with turning pages dealing with the American coal industry. They may be curious to compare it with the mining industry elsewhere, to seek points of similarity or contrasts between the American and the foreign coal problems. For their benefit a few references are given to British coal.

Coal Industry Commission, Great Britain, 1919, *Report and Minutes of Evidence*. A thorough examination of the organization of the British coal industry in 1919 with testimony by the most eminent representatives of the owners, workers, consumers, and economists.

Annual Reports of H. M. Inspector of Mines. A statistical summary, including figures of production, accidents, machinery used and installed, laborers employed, miners' earnings, and other facts about which figures can be obtained.

Royal Commission for Coal Supplies, 1904. An investigation into the coal resources of Great Britain, dealing with coal cutting machinery, by-products recovery, methods of consumption, preparation for markets.

Jevons, H. S., *The British Coal Trade*, 1915. A general survey of the British coal industry touching on resources, mining methods, marketing, exports, and labor conditions.

Boyd, R. N., *Coal Pits and Pitmen*, 1895. A description of the life of the miner in the 19th century with special emphasis upon the activities of labor for Parliamentary legislation as a means for remedying the evils in the industry.

Rowe, John F., *Wages in the Coal Industry*, 1922. A study of the actual wages received by British miners. Some attention is given to the resources and markets of the different districts and methods of mining.

Galloway, R. L., *Annals of Coal Mining and the Coal Trade*. An historical review of British coal mining, particularly interesting because of the light it throws on the technique employed in the early years of the industry.

Historical Review of Coal Mining, published by Mining Association of Great Britain. A series of essays

dealing with (1) the history of British mining, (2) the development and present status of technique (machinery, ventilation, transport, washing, screening). There is also a section on the miner and his union, by Frank Hodges.

Lloyd-George, David, *Coal and Power*, 1924. This is a liberal party document, with the party's proposals for a re-organization of the coal industry. It includes a good discussion of conditions which make re-organization necessary.

Hodges, Frank, *Nationalization of the Mines*, 1920. This book, by a former secretary of the Miners' Federation, is also concerned with the problem of re-organization, and the shortcomings of the industry as at present constituted.

APPENDIX C.

A GLOSSARY

Coal mining has a vocabulary of its own, much of which is unintelligible to the uninitiated. In the present work the vernacular of coal has been avoided as far as possible. There are, however, a few words and phrases which are not readily translated into English. The first time such expressions are used in the text they are explained, or their meaning is reasonably clear from the context. But some of them appear over and over again. Hence, for purposes of easy reference, the following brief glossary is appended.

Technical terms show a strange tendency to run off into a series of meanings. In this volume, however, an attempt has been made to confine each expression to one meaning and only one. The glossary covers only the meanings used in the text, and accordingly bears little resemblance to a general glossary in which all possible meanings must be covered.

B.t.u.'s. British thermal units. The yardstick for heat. The amount of heat required to raise the temperature of one pound of water by one degree Fahrenheit. The number of B.t.u.'s in a ton of coal is a rough measure of the heating properties of that coal.

Buddy. A miner's partner at work. Miners customarily work two in a room, and each is the other's buddy.

Cars are running. Railroad cars are at the tippie, so

that the mine can operate. The use of the expression is evidence of the extent to which mine operation has been held up by lack of railroad cars.

Clod. Slate which comes down with the coal. It is the miner's duty to remove the clod before loading the coal.

Company Men. All the workers in and about the mines except those engaged in shooting, cutting, or loading coal. The term dates back to the time when the miner was an independent contractor, responsible to himself alone. The company engaged merely to make his task possible and the company men were those hired to do the work for which the company assumed responsibility.

Cutter. A machine that undercuts the coal. In this volume the word is not used to mean a man who runs a cutting machine, although that meaning is common in the world of bituminous.

Dead-work. Any work done by the miner in addition to the work of cutting, shooting, and loading coal. It is sometimes very inaccurately called "unproductive work," or with slightly greater accuracy "work indirectly productive." It is in truth that part of the miner's work which is incidental to his main task of getting coal from its place in the ground into mine cars.

Equal turn. A system of distributing mine cars to the rooms, so that each miner gets an equal chance to load coal. A rule providing for the equal turn is incorporated in most agreements between operators and the union.

Face. The portion of unmined coal which is ready for mining. The face of the room is thus the portion of coal which will be mined next.

Face area. The total area of coal exposed ready for working in any given mine.

Face conveyors. Conveyors that work along the face. Obviously they can only be used with long wall mining or some of its modifications.

Fault. A break in the continuity of the coal bed.

Fly-by-night. A small mine often no more than a hole in the ground, that is opened today and closed tomorrow. A convenient scapegoat, upon which most of the ills of the industry are blamed, in spite of the fact that the total output of all the fly-by-nights in their best year is an insignificant item in the total production.

Gathering. Collecting the mine cars from the rooms when they have been filled with coal, or distributing the empty cars to the rooms. A gathering locomotive works between the rooms and some central point at which the cars are made up into trips or trains and taken to the tipple by a larger locomotive.

In-and-outer. The enterprise that engages in coal mining intermittently, and operates *fly-by-nights*.

Loader. A machine used for loading coal into the mine cars or into conveyors. As used in this book it does not refer to the man who operates the machine or who loads coal by hand. In the trade, however, this use of the term is frequently met.

Longwall. A system of mining little used in this country. For description, see Chapter VII, "The Rival Arts of Mining," p. 109.

Machine Mining. A thorough mechanization of the mining process. As used in this book, it is to be distinguished from *mining by machines*, which is merely the substitution of machine for hand labor.

Mine Capacity. See Appendix A.

Operator. The business enterprise, whether it be an individual or a corporation, which conducts mining operations.

Over-development. A term in general use to denote the undue expansion of the bituminous industry. In this volume the word is used only once, and then it is accompanied by a correct translation.

Pillar. A solid block of coal between rooms, or between entries, or at the edge of the mine workings. Its purpose is to support the roof, and it may be withdrawn (i.e. mined out) when it is no longer imperative that the roof stay in its place. Pillars are frequently wider than the rooms themselves, and therefore if they are not drawn, approximately half the coal is left underground.

Pillar drawing. Mining out the coal in the pillars when the pillars are not needed to support the roof.

Place. The room in which the miner works. But this tells only half the tale. The working place of the miner is his by the custom of the industry, and to take it from him violates a right almost as sacred as a property right recognized by law.

Reserves. Often a euphonious name for land speculations. As applied to an individual firm it includes all coal land held for future use by an enterprise at present engaged in mining. As applied to the national economy it includes all unmined coal whose existence has been established.

Room and Pillar. The system of mining most commonly used in this country. For description, see Chapter VII, "The Rival Arts of Mining," pp. 106-7.

Run of mine. Coal as it comes from the mine with

the lump and fine coal together. In statistical terminology, a random sample.

Seam. The bed of coal, often erroneously called the vein.

Snow-bird. The mine that comes with the first snow and disappears with the advent of warmer weather. The same as the *fly-by-night*.

Spragging. Placing short props under the face of the coal after it has been undercut, in order to keep it from falling while the shots are being prepared. The word is also used to mean a primitive system of braking mine cars, but it is not so used in this book.

Tamping. Filling with clay or coal dust the hole into which explosives have been placed to bring down the coal.

Thin seam differential. The additional tonnage rate paid miners for work in a seam of less than the standard thickness. This differential is not expected to be high enough to bring the miner's earnings up to the standard of those working in thicker seams.

Tipple. A high tower-like structure at the entrance to the mine, to which the coal from the mine is hoisted, and from which it is loaded into railroad cars below.

Trip. A train of mine cars, hauled either by mule or locomotive.

Wagon-mine. The most prosaic term for the ever convenient scapegoat. See *fly-by-night*.

Working area. The same as *face area*.

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